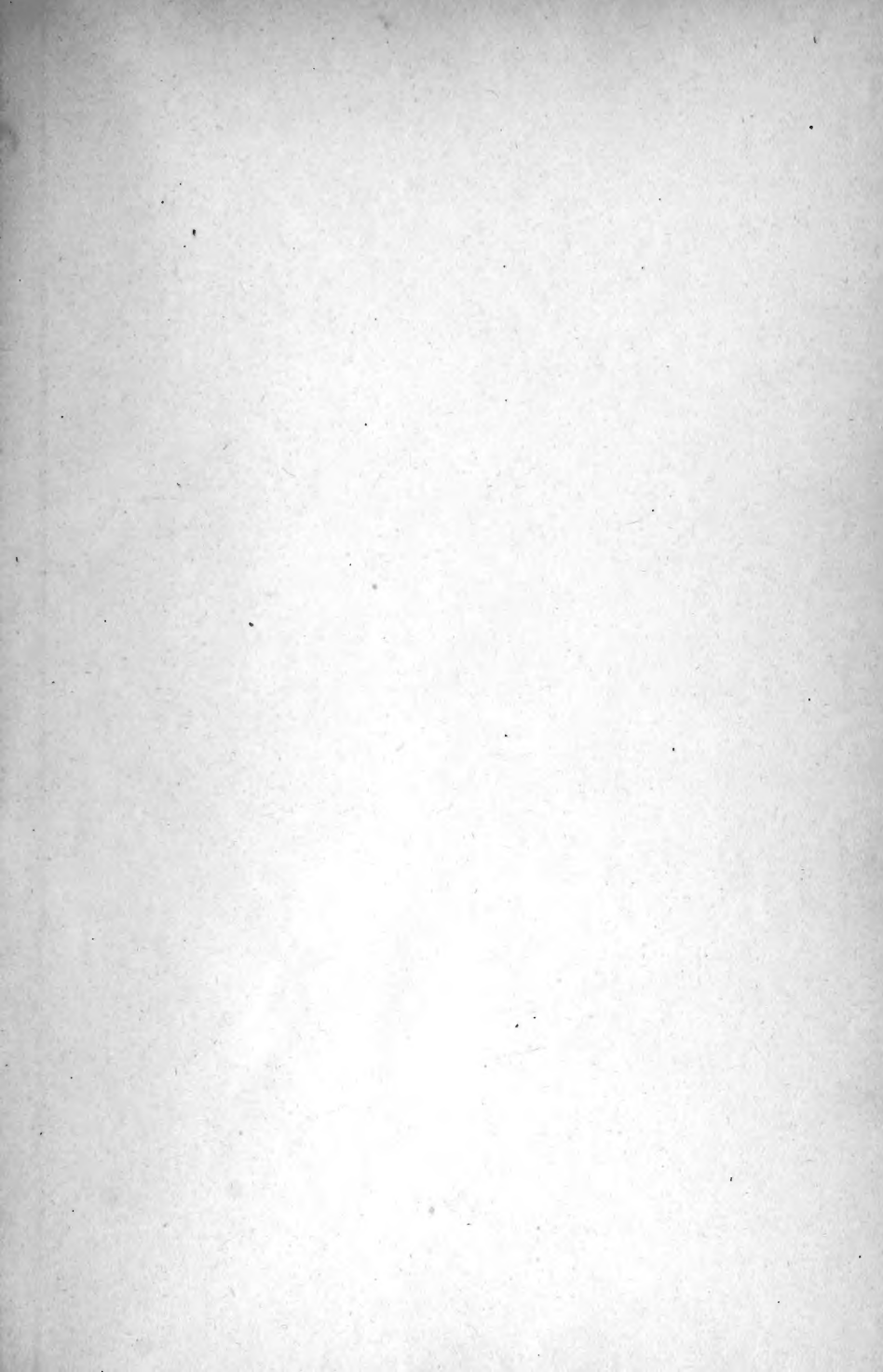


E. J. Hammond











Dr. Hanaman

THE MICROSCOPE.

AN

ILLUSTRATED MONTHLY JOURNAL

DEVOTED TO

MICROSCOPICAL SCIENCE.

- EDITED BY -

W. P. MANTON, M. D., F. R. M. S.

FRANK W. BROWN, M. D.

GEORGE DUFFIELD, M. D.

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VOLUME VII.

PUBLISHED BY

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D. O. HAYNES & CO.,
Publishers and Booksellers, 32, 34 & 36 Seitz Block, Detroit, Mich.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 83 Lafayette Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. Box 483, Detroit, Mich.

Specimens for examination should be sent to the *Microscope Laboratory*, 83 Lafayette Avenue, Detroit, Mich. In all cases the transportation charges on these specimens must be prepaid, and special directions for packing and shipping will gladly be sent upon application.

VOL. VII.

DETROIT, JANUARY, 1887.

No. 1.

ORIGINAL COMMUNICATIONS.

OBSERVATIONS ON CHÆTONOTUS.

DR. ALFRED C. STOKES, TRENTON, N. J.

EVEN those who only occasionally make a microscopical examination of a drop of water from the shadowy depths of a weedy pond, or from the dim shallows of a Lemna-covered pool, must have met with one or more specimens of that group of little animals which Ehrenberg named Chætonotus, or the bristle-backs. In their favorite habitats they abound almost as numerous as the Infusoria, and although the various species have much in common, so far as general contour is concerned, their external ornamentation, or rather their protective coat of mail, is wondrously and beautifully varied in appearance and structure. It is to this external ornamentation then that we are compelled to look for aid in distinguishing the several species common to our fresh waters.

All the Chætonoti are lithe and graceful little creatures, attractive by reason of their symmetrical form, their easy and rapid movements, their ornate cuticular appendages, and on account of their bravery and evident ability to take care of themselves. They are all free and rapid swimmers, with rather an irascible and pugnacious disposition. Although the mouth is entirely unarmed, with the exception of the single series of setose cilia encircling it, upon this part the little creatures seem to depend for defence, or as a reminder to colliding or incautious inhabitants of the same water, raising the head and striking repeated and comparatively violent blows, at the same time opening the œsophagus with a characteristic snapping movement. This applies to *Ch. loricatus* especially, but I have seen

Ch. acanthodes strike the soft-bodied infusorian *Lagynus*, and tear away the sarcode in drops and dripping shreds, which the assaulting animal swallowed. In view of these qualities, which are striking in more senses than one, it seems rather strange that they should seek the oozy depths of the ponds and the dark places where the aquatic plants thrust their roots into the mud. Yet at times they are taken among the rootlets of the floating *Lemna*; I have even found their eggs among these tangled filaments, where the parents have carelessly dropped them. The food supply is the probable secret of the preference. The organic debris, the fine residual detritus of the microscopic plants and animals whose life has been quenched in the waters, appears to form their chief nutriment. In two instances, both being with different individuals of the same large *Ch. rhomboides*, a living diatom was swallowed. These are the only cases that I have seen where any but minute particles were accepted as food.

Although the animals are abundant in our fresh waters, Prof. C. H. Fernald's interesting paper on *Ch. lanus*, Ehr., published in *The American Naturalist* for December, 1883, is, so far as I know, the only one on the subject in American print, with the exception of allusions scattered through various journals where the writers usually seem to doubt the correctness of the identification. This earliest discovered European species, therefore, is the only one noticed in this country so far as there is any record. In Europe the literature is but little more extensive. Joblot, in 1718, evidently figures and refers to one form which he calls "*Poisson à la tête tréflée*," a fish with a trefoil head, but to old Joblot almost everything aquatic and microscopic was a fish. Ehrenberg, Dujardin, Schulze, Gosse, Metschnikoff, Ludwig and Bütschli are the more important and accessible European writers on the subject in general.

A glance at the figures in Plates I and II will show, as has already been said, that the bodies of all closely resemble each other in outline. In internal structure the differences are also surprisingly slight. The animal consists of a free-swimming, flexible, elongated body, the anterior extremity usually enlarged to form the so-called head, a slight constriction behind this part constituting the neck, the central portion of the body being formed with convex lateral borders and a more or less strongly arched dorsum, the degree of dorsal convexity depending upon the presence or absence of an ovarian egg, the region being variously appendaged and suddenly narrowed to form the posterior extremity which is conspicuously bifurcate, the furcations constituting two short, curved and flexible caudal

appendages. The lower or ventral surface is a flat and nearly level plane extending beneath the entire body, and bearing two or more longitudinal bands of cilia. The mouth opens on this surface near the frontal border, the anus at the opposite extremity between the caudal branches. The animal also possesses an oesophagus, intestine, ovary, muscular, nervous and water-vascular systems, with two caudal glands, and, in one species at least (*Ch. larus*), a sub-intestinal gland said to represent the testes. All the species are reproduced by eggs, none, as Prof. Fernald remarks, being parasitic at any stage of their development, so far as now known.

These little animals have given the systematist a heap of trouble. They have been tossed about from Rotifera to Infusoria and Turbellarian worms, and finally to a distinct order, where they probably belong. Ehrenberg classed them among his Rotifers, and Gosse, writing twenty years ago, offered an extended argument to show that they belong where Ehrenberg had placed them, rather than among the Turbellaria to which they had been relegated by Schulze writing ten or twelve years before Gosse. Dujardin included them among his Infusoria; Metchnikoff, in his order, Gasterotricha; Claus includes the genus in two groups of small animals allied to the Rotifera; Huxley says it probably belongs to an annectent group between the Rotifera and the Turbellaria; and finally Bütschli also elevates the genus into an order which he calls the Nematorrhyncha, placing it between the Nematoda and the Arthropoda, of these last making two limbs to that branch of the genealogical tree from which springs the Rotatoria twig.

There are in our waters several species, and although all of them may have been observed, none of those found here, with the exception of Ehrenberg's *Ch. larus* and *Ch. maximus*, have been recorded either in this country or in Europe. My field has been limited to the region about my own home, and has perhaps not been thoroughly explored; it is therefore more than probable that many besides those to be referred to here await the search of the patient microscopist. To collect them, gently scrape the surface of the oozy bottom of shallow ponds, as Dr. Leidy recommends for the gathering of Rhizopods; and let the collector also sweep his dipper under the lily leaves, and among the submerged stems of the Nuphar, and he will not be disappointed.

The "swollen head," as a rule, is obscurely triangular, but with three or five distinct rounded lobes, the postero-lateral enlargements merging into the origin of the neck-like region. The frontal

margin bears four tufts of long, tactile and vibratile hairs, which the animal can move singly or together in the cluster. On the rear part of the neck, and on the posterior portion of the back near the caudal furcation, there are four additional hairs, two on each of these parts standing perpendicularly to the cuticular surface, but apparently without vibratile power. They are presumably tactile, and have not, so far as I know, been previously observed. They are present in every species that has come beneath my notice. They are shown in Plate I, figures 2, 8 and 9, and in Plate II, figure 21; from the other figures they have been omitted.

The back and sides are variously armed with scales, hairs, spines or pricks, and on some individuals with both scales and spines. Ehrenberg instituted the genus *Icthydium* for that form agreeing in structure with *Chaetonotus*, except that it has no hairs or other appendages on the back. The genus contains but one species, *Icthydium podura*, probably Joblot's fish with the trefoil head, which occurs sparingly in New Jersey fresh waters. Ehrenberg's description is: Posterior extremity forked, body without hair; and he states that in one instance he observed a single ventral band of cilia, while in others he could find none. If the systematist considers this a valid genus, then four of our American forms belong to it, a disposal that I should regret, and the correctness of which I should doubt. The four forms referred to are *Ch. loricatus* (Plate II, figure 6); *Ch. rhomboides* (Plate II, figures 31-35), where the dorsum of each is clothed with scales; *Ch. concinnus* (Plate I, figure 6), where the back and sides are entirely covered by hemispherical papillæ; and *Ch. sulcatus* (Plate I, figure 15), in which the same parts are sulcate in transverse furrows. Habits, internal structure and mode of reproduction are essentially similar to those of *Chaetonotus*. The body hairs are represented in them all by the four dorsal bristles hitherto overlooked.

The caudal prolongations in all the species are flexible and movable. They have an interesting function, that of anchoring the creature to the glass slide or to some support in the water while the *Chaetonotus* feeds. They are slightly enlarged distally, the center of each being partially occupied by the duct of an ovate, gland-like organ situated at their anterior end just within the body proper. These can be seen in Plate I, figures 2, 6 and 11 *d*; from the other figures they have been omitted. It is supposed that the secretion of the glands is adhesive and assists the animal in clinging to its support. Prof. Fernald in his paper already referred to says: "It

is exceedingly curious and interesting to see with what facility they use the caudal appendages, sticking them to the glass slide or cover in such a manner that, by careful focussing, one can see the sucker-like action of the tips of these organs while they sway about one way and the other in the water." The ducts seem to open in the center of the enlarged ends of the caudal prolongations.

In all the species with dorsal scales or setose appendages, these commonly extend upon the ventral surface as far as the outer margin of each ciliary band. The latter are, as a rule, two only. In but one form, *Ch. larus*, are there four, and even with it they are, according to my observation, as often two as four. The bands are near the lateral borders of the flattened ventral surface, and extend from near the mouth to the caudal furcation, and subserve locomotion only. The space between these ciliary lines is, in most species, entirely smooth and naked. In some, however, it is hispid with setose hairs, or clothed with short, recurved prickles. In still others these additions are represented by a few long setæ near the posterior bifurcation.

The mouth has a more complicated structure than appears at first glance. It is surrounded by a smooth ring, which may be called the oral annulus, somewhat elevated above the general surface, and additionally encircled by a series of setose, non-vibratile cilia. The oral annulus is so deeply striate vertically that in a direct ventral view it seems to be marginally beaded, and from the interspaces between these beads, or from the vertical furrows, the oral setæ appear to take their origin. These hairs are visible in every species that has come to my notice. The beads of the oral annulus are in some forms very minute, and in others are entirely suppressed. The cilia are in all the cause of an interesting optical illusion. That they project beyond the oral annulus more or less at right angles to the ventral plane can be positively determined only when the animal is viewed in profile. Then they are seen as conspicuous projections (Plate II, figures 21, 22 and 35), the animal seeming to be able to control their position so far, at least, as approximation and separation of their distal extremities are concerned. In the egg, before the complete developement of the embryo, these cilia present a fascicled aspect similar to that shown in Plate II, figure 35, a position also not rare in the mature, free-swimming forms. But when the animal is examined with the ventral surface upward, the oral annulus seems to be closed by a convex membrane, pierced by a small central aperture, and strongly striated. This false appearance is

shown in Plate I, figure 5, and Plate II, figure 17. It is probably caused by the ends of the cilia approximated as in Plate II, figure 35. The oral aperture proper is within and above these cilia, a circular orifice with somewhat protrusible lips, with which, assisted by the suddenly expansive action of the œsophagus, the food particles are seized.

Immediately behind the oral annulus one or more lines of vibratile cilia extend across the ventral surface from the lateral bands (Plate I, figure 5). This arrangement obtains in all the species. On each side of the oral annulus in several forms there is a tuft of adcurved cilia which merges into and is mingled with the frontal tufts of tactile hairs on each side of the head. Their function seems to be to assist in making a current that shall set in toward the mouth and carry the food particles with it. Near the four tactile tufts there are usually to be seen, on the ventral surface, four small, hemispherical, refractive and colorless bodies that have been called eyes. They are shown in Plate I, figure 5, from a specimen exhibiting them with uncommon distinctness. I have not been able to study them satisfactorily.

The structure of the oral aperture is essentially similar in all the species, and in all it opens directly into the œsophagus, an organ that varies in length and is extremely muscular. From the oral orifice it extends more or less obliquely upward, then turns toward the intestine, into which it enters for a short distance (Plate II, figures 21 and 24). Near its middle it is usually constricted. Its cavity is triangular, as shown in the transverse optic section, Plate II, figure 18, and this peculiarity holds good in all the forms observed by me. The contractions of the thick, muscular walls enlarge this cavity and, assisted by the quick protrusion of the oral aperture, draw in the food particles by what seems a suction force. The motion is very sudden and snapping. The margins of the triangular cavity are seldom straight and even, but irregularly undulate or minutely crenulate. The opening into the intestine is circular.

The tubular, tapering passage following the œsophagus serves the purpose of both stomach and intestine. It takes nearly a straight course in the median line of the body, being depressed from its normal position by the egg. The walls are, as a rule, lined by a single layer of nucleated cells. In *Ch. larus*, however, both Fernald and Ludwig have seen an external, secondary layer of small, inconspicuous cells. In *Ch. rhomboides* I have doubtfully noticed a similar arrangement.

Above the intestine in the median line of the posterior body-half, lies the single ovary (Plate I, figures 1, *♂*, 11 a.; Plate II, figure 21), the duct opening externally above the anal aperture. As a rule but one egg is formed at a time, but not rarely two or more in different stages of growth are observable in the same ovary. The size of the egg is enormous in comparison with that of the animal, not infrequently measuring nearly one-half the length of the entire body. It is extruded rapidly and apparently with no inconvenience to the animal, the oviduct and external orifice being surprisingly expansile. The egg membrane is soft and flexible to a certain degree, and the egg is often much compressed and variously distorted in its passage, remaining so for several seconds after its extrusion. It is not permanently attached to any submerged object, but is dropped wherever the *Chaetonotus* may be feeding, and is left to take its chances of being devoured by the Turbellarian worms or other innumerable enemies abounding in the superficial ooze. The eggs of many species are, however, protected by an armor of spines, papillæ or stiff hairs. Yet others are either quite smooth, or only granularly roughened. It is a curious fact in this connection, that one side of the egg membrane is always unarmed, the spines and other outgrowths being confined to the ends and one border. And no less interesting is the fact that the same species may deposit eggs whose ornamentation differs as greatly as a network of raised lines differs from pentangular hollow papillæ, or long spines with tri-radiate or four-parted ends. I at first supposed that each species deposited an egg with characteristic external markings, but a little further observation soon dispelled that pleasing illusion.

It would not be very difficult for two observers, working together, to follow the development of the embryo from the moment when the egg is extruded to the escape of the matured creature. But for one working alone it is hardly possible. The shortest time between the periods just mentioned is, so far as I have personally ascertained, about thirty hours. This is in the egg of *Ch. spinosulus* (Plate I, fig. 2). To sit at the microscope for thirty hours continuously would be no small task.

The internal changes take place rapidly in the earlier stages, and begin immediately after the egg enters the water. The contents at once become more and more granular, and soon assume a spherical form in the middle of the egg; the conspicuous nucleus divides, the parts separate, and the egg-contents undergo what seems to be total segmentation. In *Ch. loricatus* (Plate II, fig. 16) this stage is reached in about three hours.

The only *Chaetonotus* in which any structure has been seen that may have the function of a testis is *Ch. larius*, Ehr. In it a glandular organ beneath the posterior part of the intestine (Plate I, fig. 11, c) has been said by Ludwig to be the male organ, and he states also that *Chaetonotus* is hermaphroditic, but this Bütschli denies.

Nervous, muscular and water-vascular systems exist, but they are generally obscure. The two former were first observed by Bütschli in *Ch. maximus*, Ehr., but for the discovery of the latter Gosse deserves the credit, as he saw the ciliated tubules in *Ch. larius*, Ehr., and in his own *Ch. Slackie* and *Ch. gracilis*, more than twenty years ago.

The nervous system consists of two longitudinal, somewhat twisted and convoluted bands, extending, one on each side of the œsophagus and parallel with it, from the oral aperture to near the posterior region of the passage. They are shown as they appear in *Ch. maximus*, in Plate I, fig. 1, *n*.

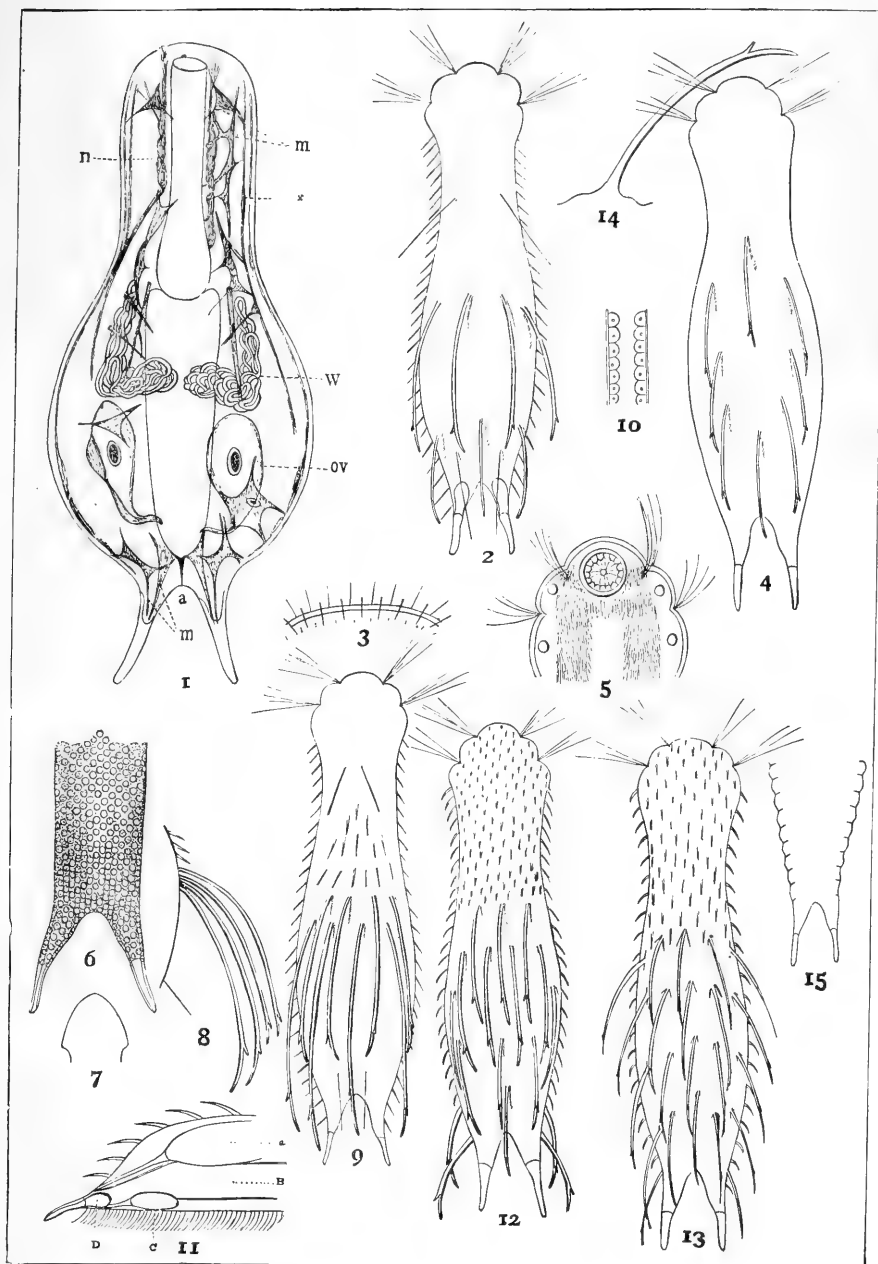
The water-vascular system is in appearance not unlike that of the Rotifera, so far as the tubules are concerned. The contractile vesicle of the Rotifers and the ciliated funnels are absent, but the long, narrow, often much convoluted tubes are ciliated within as they are in the Rotifera. In *Ch. maximus*, Ehr., Bütschli represents them as consisting of two clusters of tubules, one on each side of the intestine anteriorly, and taking a curved direction posteriorly across that passage. I have observed them in *Ch. rhomboides*, where they are much more simple in character. In Plate I, fig. 1, *w* points out the tubules in *Ch. maximus*, Ehr.

Occasionally one or more very narrow bands are visible near the lateral margins of the body and parallel with them, as shown in Plate I, fig. 1, *x*. These are supposed to be muscular fibres, and, so far as I know, have been seen by Bütschli only. The other muscular elements are more numerous. They consist of more or less scattered, radiating, contractile bodies, which are sometimes nucleated, as shown in Plate I, fig. 1, *m*.

EXPLANATION OF THE FIGURES.

PLATE I.

Figure 1. *Ch. maximus*, Ehr.; from an unusually short and stout individual, in which the internal organs were very distinct; *m*, radiating contractile cells; *x*, probably longitudinal muscle-fibres; *w*, water-vascular system; *ov*, ovary; *a*, anal aperture; *n*, nervous system. (After Bütschli.)





- Figure 2. *Ch. spinosulus*, sp. nov.; dorsal aspect.
 Figure 3. Egg of *Ch. spinosulus*.
 Figure 4. *Ch. octonarius*, sp. nov.; dorsal aspect.
 Figure 5. *Ch. loricatus*, sp. nov.; ventral aspect of head.
 Figure 6. *Ch. concinnus*, sp. nov.; posterior dorsal region.
 Figure 7. *Ch. Slackia*, Gosse; outline of head. (After Gosse.)
 Figure 8. *Ch. longispinosus*, sp. nov.; lateral view of posterior dorsal region.
 Figure 9. *Ch. longispinosus*, dorsal aspect.
 Figure 10. *Ch. longispinosus*, intestinal cells.
 Figure 11. *Ch. larus*, Ehr.; optical section of posterior part; *a*, ovary; *b*, intestine; *c*, testes (?); *d*, caudal gland.
 Figure 12. *Ch. enormis*, sp. nov.; dorsal aspect.
 Figure 13. *Ch. acanthophorus*, sp. nov.; dorsal aspect.
 Figure 14. *Ch. acanthophorus*, dorsal spine.
 Figure 15. *Ch. sulcatus*, sp. nov.; posterior dorsal region.

(To be continued.)

THE MICROSCOPIC EXAMINATION OF URINARY DEPOSITS.

FIRST PAPER.

C. G. JENNINGS, M. D.,

Professor of Chemistry and Diseases of Children, Detroit College of Medicine.

THE microscopic examination of urinary deposits is of much value in modifying and correcting the results of the chemical analysis. A little attention to the details of technique is necessary, even in this simple procedure, and is well repaid by the greater accuracy with which the examination can be made.

The urine should be placed in a vessel that will enable the sediment to fall into as small a space as possible, covered to exclude dust, and set aside in a moderately cool place for ten or twelve hours. The best vessel for the purpose is a glass cylinder one inch in diameter and about six inches long. The urinometer glass, or a large test-tube on foot, answers the purpose well. The conical wine glasses, often recommended, are open to the objection that the sediment collects all along the sides as well as at the apex of the cone. When the sediment is scanty, and when a careful search for casts, etc., is demanded, the urine containing the sediment may be taken from the bottom of the cylinder with a pipette, and transferred to a small test tube and allowed to stand for a few hours longer. The deposit in the bottom of this tube will be so concentrated that no object in it can well escape scrutiny.

A few drops of the urine containing the sediment are taken up in a pipette and a drop deposited on the center of a slide, a thin cover-glass placed over it and the superfluous urine absorbed with a piece of blotting paper. The top, middle and lower part of the sediment should be successively examined to bring under observation the constituents having different specific gravities.

A cupped slide may be useful in searching a scanty deposit, but the examination is hindered by the depth of the fluid and the constant focusing of the microscope which is necessary. I find it more convenient to examine a number of specimens on a flat slide. A drop of a nuclear staining fluid, as ammonio-carmin, added to the drop of urine greatly facilitates the examination and well repays one for the little extra trouble. Casts, epithelial cells, organic debris, etc., take the stain and contrast well with the unstained crystals. For the detection of delicate hyaline casts this staining is of great value.

For the examination a good $\frac{1}{2}$ in. objective, with a B eye-piece, answers the purpose fairly well, but for the resolution of fine crystals and delicate organic structures a moderately good $\frac{1}{8}$ in. or $\frac{1}{6}$ in. objective is to be preferred.

A little procedure that will be found very useful, particularly for the study of casts, is to place the tips of the two index fingers gently on the cover glass, and, with the object in view, to move the glass slightly to and fro. By this movement a suspected cast or a crystal may be rolled over and examined on all sides. The cylindrical shape of many delicate casts can be shown only by this method. It is delightful to note how this little manipulation enables one to determine the character of a doubtful object.

Various extraneous matters, as particles of dirt, fibers of cotton, wool, silk, etc., find their way into the urine, and the inexperienced student is always first attracted and puzzled by them. A little study soon gives such familiarity with them that they are passed over without a thought.

MICROMETRIC MEASUREMENTS.

M. D. EWELL, F. R. M. S.

LAST winter in order to test the relative accuracy of micrometric measurements with different apparatus in the hands of different competent observers, I ruled on a glass slide 15 spaces of approximately .004 and .008 inch, without applying any corrections for

the errors of the screw of the ruling engine, and put the slide in the hands of a well known microscopist who has had much experience in micrometry, with the request that he measure the spaces and transmit the results to me under cover of a sealed envelope, and then hand the plate to some other competent observer, who should do the same, and so on. No one of the observers knew the results arrived at by the others till the work was entirely completed, and the tabulated results read at a meeting of the State Microscopical Society held in Chicago. The results are quite striking. As will be noticed every observer used a Rogers' stage micrometer, the extreme accuracy of which may be seen by consulting a prior number of this Journal, Oct., 1885, wherein is published an investigation of ten of the $\frac{1}{100}$ mm. spaces of such a micrometer, ruled on speculum metal. I suppose that this particular micrometer is no more correct in its ultimate subdivisions than others by this maker used by observers generally, so that some other explanation must be sought for the discrepancy in these measurements (amounting in many instances to more than 1 mikron,) than errors in the standards used. I have ruled another plate with spaces varying from 5. mikron to 10. mikron, to be measured with as high a power as the observer can command, with a view of determining whether a similar discrepancy will be found in the use of high powers. If a similar discrepancy shall be found upon this trial, the result will tend to shake one's faith in the assertions of some of our so-called experts who pretend to be able to identify a person by the measurement of his blood corpuscles.

As the investigation is not completed, I simply publish the results so far obtained without further comment than to state that these measurements were not made by novices, but by expert manipulators, most of whom have had long experience in the use of the microscope and micrometer.

The table needs no further explanation than that the measurements are to the nearest hundred-thousandth of an inch.

The English, rather than the metric system, was chosen for the reason that some of the observers had no metric scale, and it was thought advisable that each series of measurements should be on the same scale as well as entirely independent of the others. Under each measurement will be found the correction "+" or "-" necessary to make the measurements equal to the mean.

I still have the slide in my possession, and if any microscopist would like to measure it, I will mail it to him.

FIRST SERIES OF TEN SPACES.

	1	2	3	4	5	6	7	8	9	10	
INSTRUMENTS USED.											
Dr. C.....	.00404"	415	417	415	411	407	409	408	405	404	4-10 objective; Bulloch filar micrometer; Rogers' stage micrometer; mean of 5 measurements.
Prof. B.....	415	418	419	415	412	410	407	408	408	408	¼ objective; camera lucida; Rogers' stage micrometer; mean of 5 measurements.
Mr. B.....	411	418	426	423	420	411	407	407	409	412	4-10 and ¼ objective; Bulloch filar micrometer; Rogers' stage micrometer; mean of 20 measurements.
Mr. H.....	412	419	427	427	419	412	410	407	408	410	Gundlach 1.5 objective; camera lucida; Rogers' stage micrometer; mean of 5 measurements.
Mr. S.....	409	417	425	425	421	413	409	409	409	409	¾ Hartnack objective; Rogers' glass eye piece micrometer; Rogers' stage micrometer; mean of 5 measurements.
Dr. E.....	409	415	421	422	417	410	405	404	405	408	1 and 3.5 Zeiss objective; Bulloch filar and Rogers' screw stage micrometer; Rogers' stage micrometer and "Cm. A."; mean of 13 measurements
Mean.	410	417	422	421	417	411	408	407	407	408	

SECOND SERIES OF FIVE SPACES.

	1	2	3	4	5	Same apparatus as above, and same number of measurements.
Prof. B.....	.00840"	843 +2	832 +2	815 +3	821 +2	
Mr. B.....	839	848 0 -3	834 0 -3	821 -3 +1	922	" " " " " "
Mr. H.....	843	843 -4 +2	837 -3	815 +3	826 -3	" " " " " "
Mr. S....	842	850 -3	834 0	822 -4	826 -3	" " " " " "
Dr. E.....	833	843 +6	831 +3	816 +2	819 +3	" " " " " "
Mean.....	839	845	834	818	823	

MOUNTING WHOLE INSECTS.

A. Y. MOORE, M. D., MICROSCOPIST, CLEVELAND, O.

IN looking over the average cabinet of mounted insects, it will be found that nearly all are mounted in the old-fashioned way—soaked in potash and flattened. Whatever beauty such a preparation may have, it must be admitted that it can not instruct the observer to the extent that one mounted in the more modern way would, and, as the majority of American microscopists pay so little attention to this, it may be admissible to say a few words upon the subject.

Nearly all insects mounted without pressure should be mounted in cells, and the choice of cell material frequently becomes a matter of considerable importance. Glass is probably the best material as a rule; brass cells should not be used with balsam mounts, unless protected by some cement or plated with some other metal, for the balsam will usually turn green. Probably the best cement for attaching the cells to the slides is the best marine glue. Small pieces should be cut up and placed upon the slide. The slide should be gradually and evenly heated, and the cell—also hot—should be carefully lowered into the glue. To insure proper contact with the glue, gently rotate the cell and press it down carefully. Both the slide and cell should be chemically clean before the glue is used at all. After the glue has become hard—which will be when the slide is cold—cut away all superfluous glue with a sharp knife blade, and clean up with chloroform on a piece of fine cloth.

When the cell is complete, it should be rather thickly coated, inside and out, with a solution of gum containing sufficient glycerine to prevent brittleness. When dry, the insect should be placed in the cell, and none but *fresh* insects should be used. It is a good plan to keep the insect alive for a few days before the process of mounting is begun, as it will probably clean the dust off of itself better than the microscopist could. It should then be “gradually killed” by chloroform. I say *gradually* because I mean that it should be quietly put to sleep and not allowed to awaken. This will kill it without shriveling up the legs, etc. The insect may then be placed in the cell and arranged in position with a needle. When satisfactorily arranged it should be made to adhere to the gum by gently breathing into the cell to soften the gum. When dry—which will depend upon various conditions, such as temperature and conditions of the surrounding air—place a few drops of strong alcohol in the cell and cover with a large cover glass. After remaining several

hours, the alcohol should be changed ; and this process repeated, according to the size of the insect, until all the water in its body has been replaced by alcohol. Then a small quantity of oil of cloves should be placed in the cell with the alcohol and allowed to remain for several hours, at the end of which time the cell should be filled with the pure oil, which should be allowed to remain several days. Now, the cover should be taken off and the entire slide immersed in very pure turpentine, and the length of time of the immersion will depend upon the natural opacity of the insect. If, however, the insect should be very transparent at the start, it may not be at all necessary to use turpentine, but at once pour out the oil of cloves and fill the cell with Canada balsam.

Sealing a fluid balsam mount is not always as easy as it looks, and if not properly done at first may have to be done over again. For this reason it is well not to get in a hurry, but be sure of every step before another is taken. The balsam used should be rather thick. Never use balsam containing benzole or chloroform for cells, as these solvents are extremely volatile and it is difficult to seal them so that they will not eventually leak. After pouring out the oil of cloves or turpentine, as the case may be, carefully fill the cell rounding full of the balsam and set the slide away out of dust for some time. This will give the bubbles a chance to come to the surface and get out. In putting on the cover, do not conclude that because the cell is rounding full there will be no danger of enclosing bubbles. The surface balsam will have become somewhat "skinny," and if the cover be lowered upon that the chances are that several bubbles will be enclosed, which may require considerable work to remove them. This danger, however, may be prevented by putting a small drop of turpentine upon the top of the balsam or under side of the cover, and lowering very carefully. The cover should not be pressed down immediately, but allowed to remain upheld by the balsam till satisfied that all bubbles are out, when it may be carefully pressed down and the surplus balsam which has exuded from around the cover may be scraped away with small pieces of cardboard, and subsequently cleaned by a piece of cloth and chloroform, or alcohol. Never use turpentine for cleaning off balsam, as it is liable to penetrate the cells. When thoroughly clean allow the slide to stand, at an average temperature, for several hours, and then seal with shellac (in alcohol). After the shellac has become thoroughly dry, any cement may be put on and the slide finished in modest black, or

"Fourth of July style," as is so frequently done by those who mount slides in which the circle is the only redeeming feature.

This process will leave the muscles, etc., in their natural position, which would not be the case had the insect been first dried.

"CAN HUMAN BONE BE TOLD FROM OTHER BONE BY AID OF THE MICROSCOPE?"

C. H. STOWELL, M. D., F. R. M. S.

Professor of Histology and Microscopical Technology, University of Michigan.

A CASE recently came under my observation. It was very important to the prosecution to decide whether certain small pieces of bone were human or not.

There was the strongest circumstantial evidence to show that after this murder was committed the criminal took an ax and chopped the body into small pieces and burned it in a large box stove. Afterwards, fearing detection, he took the ashes from the stove and threw them near a stump in a yard where several animals were in the habit of gathering. Several small pieces of bone were here found. If it could be proved that these pieces were from human bone it would be an additional link in a very complete chain of circumstantial evidence.

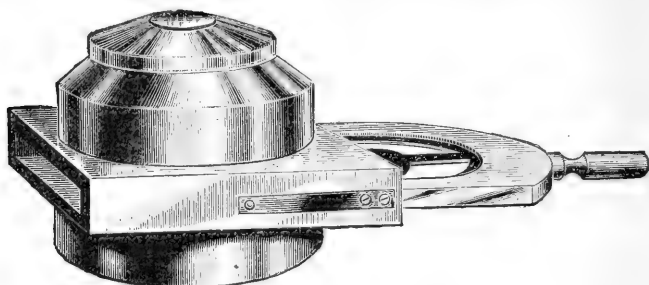
A careful investigation of the subject led me to believe that never before had such a question been raised in the courts. Practical experience had shown me that there was a difference between the compact bones of man and many of the lower animals. What was this difference? Was it definite enough to enable one to put himself on record as to just wherein this difference consisted? In the case of the compact bones of the ox, for instance, the lacunæ appear smaller, and the number of Haversian canals with their system of lamellæ, more numerous than in man; but how accurate would this test be if certain compact bones from man were compared with certain less compact bones from the ox? And how general could such a test be made in the case of many other animals?

As a result of some labor in this line I was obliged to testify substantially as follows: If the question were between a certain known bone from man and a certain known bone from the ox or from any of the lower animals, I believed the microscope would enable us, many times, to decide to which animal the bone belonged, even when we were in the possession of a comparatively small piece.

In answer, however, to the very general question at the head of this article a general negative must be given.

NEW INVENTIONS.

THE BAUSCH AND LOMB CONDENSER AND SUB-STAGE.—The instrument figured consists of a condenser and sub-stage, the latter having five stops, diaphragms and blue glass. The lenses of the condenser are of such a size as to utilize almost all the rays of light which may pass through the sub-stage ring. In order



that objectives having a large angular aperture may be used, the condenser has been made with a numerical aperture of about 1.42 (another of 1.20 is also manufactured). Its volume of light is sufficient with the highest amplification, and although it gives an intense light at the focal point, it may be distributed over a large space by varying its distance from the object. It will work both dry and immersion. The mounting of this condenser is new and simple, and is so arranged that the instrument can be used where the sub-stage is adjustable or fixed. The diaphragms are separate, and a click is provided when one is in central position. It appears in all respects one of the best condensers and sub-stages now in use, and is a welcome addition to the microscopist's armamentarium.

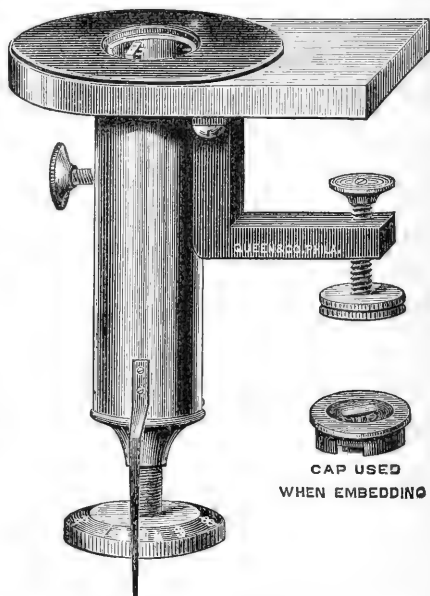
A NEW SELF-ADJUSTING FROG PLATE.—James W. Queen & Co., send us this little device. Much time can be saved through its use,



as the tedious process of boring suitable holes and passing threads, as in the usual way, is avoided. The *modus operandi* here

employed is very simple. After wrapping the frog in a moist cloth and laying it on the plate, the binding-cord is passed back and forth over the plate and around the pins, and its free end is secured by simply drawing it under one of the small spring-clips shown on the edge of the plate. The threads which stretch the web are looped over the toe-nails and secured in the same manner. The long springs shown in the cut hold the plate securely on any stage.

THE NEW MODEL MICROTOME.—The advantages claimed for this microtome are that it can be used either for imbedding specimens for section cutting, or, as in the case of most vegetable and many firm tissues, securely clamping them. When it is desired to imbed, the clamp is lowered by the screw, and the cap fitted in to protect it from the embedding material. The clamp, when used, will be found very effective, grasping the specimen evenly and firmly. The finish and get-up of the instrument are perfect in detail. The stage is of darkened glass, and the metal portions of brass finish. A micrometer screw is attached, thus allowing one to obtain sections of any desired thickness. A thoroughly satisfactory instrument. It is manufactured by James W. Queen & Co.



PROCEEDINGS OF SOCIETIES.

THE SAN FRANCISCO MICROSCOPICAL SOCIETY.

OCTOBER 16, 1886.

THE annual reception tendered by the San Francisco Microscopical Society to its friends at Pioneer Hall Saturday evening, proved to be a most enjoyable affair. Long lines of tables were ranged along three sides of the hall and on the platform. On these were placed forty-five microscopes (the largest number ever exhibited

at any one time on this coast), embracing examples of the best work of such renowned opticians as Zentmayer, Ross, Beck, Zeiss, Crouch, Bausch & Lomb, Grundlach, Nacet, Bulloch, Baher and others. Among the objectives used, in addition to the productions of the makers already named, were choice specimens of the skill of Tollés, Spencer, Powell & Lealand, Hartnack and Swift. Nearly all the lamps with the instruments were screened with Japanese shades, which not only produced a pretty effect, but added to the comfort of visitors and exhibitors by protecting their eyes from a glare of light. The list of guests comprised many of the prominent names in social and scientific circles of this vicinity, and the occasion was evidently a thoroughly enjoyable one to all concerned.

The first exhibitor on the list was Dr. C. P. Bates, who showed an interesting slide of living infusoria, chiefly *Monadina*. The strange forms and erratic gyrations of these lowly organisms always prove attractive to observers.

At the next table the circulation of the blood was beautifully shown by Dr. J. M. Selfridge, in the mesentery of the living frog. The sight of the oval corpuscles coursing swiftly through the blood vessels, never fails to excite wonder and delight.

Crystals of gold and silver were displayed by George C. Hickox under his large Beck binocular, and his exhibit was an exceedingly attractive one. Some large fern-like crystals of gold were particularly admired.

E. J. Wickson showed a fine series of living scale insects under four excellent instruments. As the ravages of insect pests in this State are at present attracting much attention, this exhibit was received with peculiar interest. The red orange-scale (*Aspidiotus aurantiae*) was a most striking object.

A. H. Brechenfeld exhibited the head of a jumping spider, whose six gleaming eyes gave it a peculiarly ferocious appearance; the head of a male wasp, showing the beautiful structure of the sucking lingua or tongue, and a slide of young oysters (rolling in fluid), to which polarized light imparted gorgeous hues.

The exhibit of Chas. W. Banks was, as usual, a large and varied one. An ingenious apparatus for showing the combustion of various metals in the electric arc received many admiring comments. Under another microscope were shown the brilliant effects produced by the passage of the electric spark through a film of loose carbon. It was one of the most effective displays in the line. A number of other attractive objects were shown by Mr. Banks, notably a fine slide of a

brittle star fish (*Ophiocoma neglecta*), beautifully shown under dark field illumination.

At the next table Dr. J. H. Stallard had a fine array of seven microscopes under which were arranged slides illustrative of the structure of normal and also of diseased arteries. The various tissues had been skillfully differentiated by various staining processes, and the distinctive features of each slide were carefully explained by the exhibitor.

The elegantly sculptured egg-cases of the house-fly were shown by William Payzant, and their beauty was a revelation to most of the spectators. The same gentleman exhibited a slide of the pretty little "brine shrimps" from the evaporating pans of the salt works near Alameda.

The next exhibitor, W. F. Myers, showed a slide on which the delicate and beautiful structure of the mosquito was effectively displayed. He also exhibited an attractive mount of red marine algæ.

L. M. King was announced to exhibit living rotifers, but at the last moment these were so disobliging as to die. In their place the slide contained a fine example of the larva of the day-fly (*Ephemera vulgata*), which was examined with the deep interest always excited by living organisms of this kind.

An exhibit resembling the most delicate frost work was shown by A. S. Brackett. It consisted of the beautiful crystals of muriate of cocaine, strikingly displayed on a dark ground. A neat placard, giving the name, derivation, uses and chemical characteristics of this salt, was a commendable feature of this exhibit.

Perhaps the most unique object on the entire list was that shown by Prof. Hanks. It was an insect of a species now extinct, perfectly preserved without the least apparent distortion, in a block of amber, wherein it had rested for untold ages. As compared with this perfect specimen of nature's embalming, the mummy of Egypt's most ancient King is a thing of yesterday.

Henry C. Hyde's exhibit consisted of the blood-red crystals of platino-cyanide of magnesium, selected diatoms shown with dark-ground illumination, and the resplendent scales of the Brazilian diamond beetle. A noteworthy feature of the exhibit was that each mount was illuminated by a minute electric incandescent lamp, attached to an arm with universal movement. The light was shown to be perfectly manageable, intense in quantity, and soft and pure as to quality. To the microscopists present, this exhibit was of especial interest.

At the adjoining table, the next exhibitor, Arthur M. Hickox, showed the crystals of brucine, using polarized light. Brucine is an alkaloid extracted from *Strychnos Nux vomica*, and its oddly arranged crystals polarize brilliantly.

Dr. Thomas Morffew exhibited a slide showing the perfection to which microscopic engraving on glass can be carried. He also showed one of Möller's wonderful "Typen-Platten" of diatoms, the name of each being photographed beneath it.

The President of the society, Dr. S. M. Mouser, showed a fine line of specimens of anatomical and pathological subjects. An injected ileum of the rat was much admired for its beauty. A slide of *Bacillus Anthracis* was shown with one of the new Zeiss lenses made of the recently perfected optical glass. The crisp definition of this objective was particularly noticeable.

J. Z. Davis followed with several slides of vegetable sections which had been double-stained. The different layers of tissue were sharply defined and the coloring was brilliant.

A slide of *Bacillus tuberculosis* was the subject chosen by Dr. F. Riehl. Using a dry lens and an amplification of 275 diameters, the bacilli were shown with great clearness.

The absorption bands in the spectra of various colored solutions were shown by Professor Thomas Price with a micro-spectroscopic ocular. This method of testing has become of great value in many directions, notably the detection of blood-stains. The presence of almost inconceivably small particles of coloring matter can be made manifest by this instrument.

The last exhibitor was F. L. Howard, who showed a fine mount of the beautiful Polyzoan, *Bicellaria ciliata*, using polariscopic illumination to produce the glowing tints so much admired. The ingeniously contrived microscopic lamp of this exhibitor also received much favorable attention.

AMERICAN POSTAL MICROSCOPICAL CLUB.

BOX "M" containing two valuable slides of "Cole's Studies" reached the office of THE MICROSCOPE Nov. 9th. These slides are very interesting to all observers, because all are aware that Cole's preparations are among the first in the world. With these slides came a descriptive pamphlet, illustrated with colored lithographs of a certain part of the tissue on the slides, so that those who are not usually interested in the ordinary histological specimen

cannot but find fields for new study, and learn much from the reading alone.

Slide No. 1 consisted of a transverse section of tendon showing all the histological relations with great minuteness.

Slide No. 2 contains a section of fatty tissue, in the cells of which are some fat globules and stearine crystals; the adipose tissue is beautifully seen, and the staining makes the tissue appear clear and distinct.

It is worth while to use the polariscope when examining the stearine crystals.

Following each specimen is the mode of preparation and staining the tissue.

EDITORIAL.

PUBLISHERS' NOTICE.

It is not without some feelings of pride that we send this edition to so large a number of new readers; the actual number of copies issued this month is sixty-two thousand, (62,000) those additional to our regular subscribers being sent to the physicians and surgeons throughout the United States and Canada.

We should not undertake the general introduction of THE MICROSCOPE to the medical profession had we not perfect confidence in the ability of the gentlemen in charge of the editorial department to make this the leading Microscopical journal of our country, and to render it of particular interest and value to their brother practitioners, as well as to the special student of microscopy.

We wish to acknowledge courtesies received from the several gentlemen with whom we have been associated in the issue of this special edition, and to our advertisers we are particularly indebted for their words of encouragement, and for their substantial support in carrying into effect the particular plan we had adopted.

THE CLINICAL IMPORTANCE OF BACTERIOLOGICAL INVESTIGATIONS.

We believe that few physicians as yet appreciate the practical value of examinations of secretions and tissues for micro-organisms. We are on the eve of an era in clinical medicine in which bacteriological investigations are to occupy as important a position for the purposes of diagnosis, prognosis and treatment, as the physical examination of the chest and the analysis of urine do at the present time, and it behooves every physician who hopes to keep

pace with the latest advances in his art to make himself familiar with practical bacteriology. As there were physicians thirty or forty years ago who would not take advantage of the benefits of physical examinations, so today many, satisfied with their present methods, will pass over the positive information which an examination for micro-organisms will give. Not all physicians, however, who are fully conversant with and wish to take advantage of the best resources of modern medicine are able to devote the time that is necessary to acquire dexterity in the technique of bacteria staining. Others again do not wish to purchase the somewhat costly apparatus that is requisite. To these the various microscopic laboratories throughout the country offer their aid. Many of the specific diseases have been proven to be due to micro-organisms and it will not be long before the pathogenic bacteria of them all will be discovered. In at least four of these diseases, anthrax, relapsing fever, tuberculosis and cholera, the diagnostic value of the finding of their characteristic bacteria is of prime importance. The first two of these diseases are not very common in our country and many of our physicians are unfamiliar with their clinical histories, and this fact enhances the value of a positive diagnostic sign.

Too much cannot be said of the importance of a search for tubercle bacilli in suspected tuberculosis. The unity of the various forms of phthisis is now definitely settled—they are but clinical varieties of tuberculosis. "If, now, we discover in the sputum that parasite, which we know to produce tuberculosis, we are forced to conclude that a tubercular process is going on somewhere in the respiratory apparatus, including the mucous membrane of the mouth and pharynx." (Friedlander.) Tubercle bacilli are found in great abundance on every point of tuberculous ulceration, however small, and may often be demonstrated weeks or months before a positive opinion can be formed of the nature of a suspicious apex-catarrh. Can the physician afford to neglect such a valuable aid to diagnosis and guide to treatment? The finding of bacilli although of grave significance cannot be regarded as a positive indication that the result will be fatal. Their discovery reveals the powerful enemy we have to fight and shows the necessity of strengthening our defenses against further invasions. It is general, not local, tuberculosis that generally kills. A tuberculous spot may exist for years without immediately compromising the patient's life, and so long as the disease is localized we may hope that its progress may be checked; indeed, post-mortem examinations show that fully fifty per cent. of the bodies

examined were, at some period during life, the subjects of localized tuberculosis. "On the other hand, the constant absence of tubercle bacilli from the sputa, may be regarded as a certain sign that the destructive processes of tubercular phthisis are not then going on in the lungs." (Friedlander.) For the diagnosis of non-specific destructive conditions, as the formation of abscesses, the disintegration of tumors, etc., this negative sign is of the greatest importance.

Localized tuberculosis in tissues other than the lungs can in the same manner be diagnosticated; and the importance of the recognition of the infectious nature of a cheesy scrofulous gland, a discharging sinus, or a chronic joint inflammation is apparent.

The country has thus far escaped the invasion of the cholera epidemic which has decimated so many districts of Europe during the last few years. At any moment, however, the disease may be imported into our midst, and the responsibility of a prompt and correct diagnosis may fall to the lot of some practitioner remote from the great commercial centers. The responsibility which will be thus thrown upon the physician is a fearful one. Upon the promptness and accuracy with which he recognizes the disease will hang the lives of hundreds of our citizens. Whether the disease shall be checked in its incipency or be allowed to spread until almost beyond control will depend upon his knowledge and judgment.

Many cases of cholera morbus resemble cholera so closely in their symtomatology that a certain diagnosis from the symptoms alone is impossible. In the dejecta of cholera, however, there is an organism, the comma bacillus of Koch, that is characteristic of that affection, and, when found and identified, establishes the diagnosis beyond all possibility of doubt. The physician, or officer of the health, who neglects to utilize this positive knowledge is taking a fearful risk.

A PORTRAIT and sketch of Prof. Wm. A. Rogers, A. M., F. R. M. S., President of the American Society of Microscopists, which should have appeared in this number of THE MICROSCOPE, was unavoidably delayed in printing, and will, therefore, appear in the February issue. It will be furnished only to subscribers.

AS PREMIUMS TO SUBSCRIBERS we are sending out some choice slides, many of which can hardly be duplicated. We have some good specimens of *Bacillus Tuberculosis*, which are in great demand. Subscribers desiring slides of the above will please state this when sending in their subscriptions.

THE MICROSCOPE.
TECHNOLOGY.

FINISHING BALSAM MOUNTS.

WHEN the surplus balsam around the edges of the cover-glass has become hard and brittle, the slides are ready for finishing. The first step is the removal of this surplus, by scraping it away with a pen-knife or other suitable instrument. Care must be taken in doing this not to get the point of the blade under the cover-glass, or in any way to disturb the same; for while the exuded resin may be dry and hard, that which is under the cover is probably still soft and fluid. For the same reason the operator must be careful about making pressure on the cover-glass, as in this manner a portion of the soft balsam may be forced out and its place taken, too frequently, by an air bubble which is almost impossible to get rid of. If such an accident should happen, it may sometimes be remedied by placing a drop of balsam at the edge of the cover-glass on the side opposite to the deficit. A needle is then inserted under the cover-glass and the latter slightly raised. As it rises the added balsam is drawn under it and a little manœuvering suffices to distribute the fluid evenly over the field. Before fresh balsam is added in such a case, the slide in that neighborhood must be made as clean as possible, since the balsam in entering will carry along with it any particles of dust or dirt with which it may come in contact. After refilling, the slide must be again laid away to recommence the process of hardening. After scraping away as much of the dry balsam, etc., as possible, place the slide on the turn-table and spin a ring of arabicin or gelatin cement around the edge of the cover-glass. Let dry, and as soon as this occurs, clean the slides thoroughly with a linen rag moistened with benzol or turpentine. The ring of arabicin prevents the cleansing fluid from invading the cell. After the entire slide and the top of the cover-glass are cleaned, the ring of arabicin cement may be rinsed off with clear water and the slide labeled and put away.—*Dr. F. L. James in St. Louis Med. and Surg. Jour.*

A NEW CULTURE MEDIUM.—Dr. Alex. Edington, assistant to the Professor of Surgery at Edinburg University, says that a jelly derived from Irish moss is much less opaque than agaragar and more nutritious, and is therefore to be recommended as a culture medium for micro-organisms capable of withstanding high pressure. He macerates 2 ozs. of the finest selected Irish moss in 18 ozs. water,

and after leaving it for a night, keeps it in the steam sterilizer at about 212° Fahr. for an hour and a half, stirring occasionally. It is then strained through a felt bag two or three times, when the jelly thus obtained will be found on cooling merely to gelatinize, yet able to withstand a temperature of 87° Fahr. before liquefying; but if it is evaporated, it is found to be capable of withstanding a temperature between 122° and 131° Fahr. before liquefying. In this state, if a test-tube be filled with it, it is found to present the appearance of water with only a slight degree of haziness. In order to render this more nutritious, and so better fitted for the requirements of the growth of the generality of micro-organisms, the materials recommended by Dr. Klein may be added, namely, beef peptone and ordinary cane sugar. Add to the jelly 2 per cent. of the former and 1 per cent. of the latter, and the result is a jelly almost as bright as nutrient gelatine and infinitely more so than agar, while the simple method of preparation and the price have much to recommend it.—*English Mechanic*.

WATNEY'S DOUBLE STAIN WITH HÆMATOXYLIN.—Dr. W. Kraus recently reproduced a procedure introduced by Watney for double staining by the exclusive use of hæmatoxylin. This is effected by successive staining with a strong red and a weak blue solution. The difference between the two solutions really depends upon the quantity and acidity of the alum. An intense blue is obtained by the use of freshly prepared dry alum; the red color appears when acid has become free in the alum, but best when the quantity of the alum solution is less than three times the quantity of the wood-extract. Connective tissue, the protoplasm of the connective-tissue corpuscles, and the walls of vessels are stained red. Mucus, almost all nuclei, and lymph corpuscles, are stained blue. A communication from Prof. Langhans to Dr. M. Flesch shows that this double stain takes place more simply if Delafield's hæmatoxylin be used in the ordinary way, and the preparations when mounted in Canada balsam are exposed to the light for a long time. Preparations mounted in glycerin are said to undergo this change.—*Journal R. M. Society*.

PREPARATION OF NERVES FOR MICROSCOPIC EXAMINATION.—To prepare a nerve: Dissect out a piece of the sciatic of an ox, horse, dog or cat; the piece should be an inch long and gently stretched upon a piece of wood or a match, and tied at both ends to prevent shrink-

ing, if taken from a small animal. If a larger animal is chosen the nerve trunk must be cut further down where it is smaller. Place the cut piece for 10 days in Mueller's fluid, wash, and place in alcohol; cut the sections, place in a 1 per ct. solution of osmic acid with distilled water, then place in a solution of picro carmine and let them remain until colored. If a whole nerve is used, put in a test tube, cover with picro-carmine and let it remain two weeks.—*Note Book of American Micro. Post. Club.*

ABSTRACTS.

DETECTION OF MICRO-ORGANISMS.—Since Koch devised his now well-known method of cultivating micro-organisms on plates coated with gelatine, great advances have been made in bacteriological research. Especially is this true of that branch which deals with bacteria in drinking-water. Dr. Frankland has found that, in the storage and filtration to which London water is subjected, the number of micro-organisms is reduced ninety-five per cent. Dr. Bolton has shown that the spores of anthrax remain alive in distilled water for ninety days, and in polluted well-water for a year, while the bacilli themselves are very short-lived. The comma bacillus of Koch, as is known, will reproduce itself in water. The importance of these observations is evident when it is considered that, regarding the germ theory as true, zymotic diseases may be spread by means of water impregnated with their germs.—*Science.*

THE PATHOLOGICAL HISTOLOGY OF COMPENSATORY HYPERTROPHY OF THE KIDNEY.—Lorentz has made direct micrometric measurements of the histological elements of the kidneys in seven cases of experimentally induced compensatory renal hypertrophy, with the following results: The hypertrophy consists chiefly in an increase of the cortical substance of the kidney, and, to a much less degree, of that of the parenchyma. The cortical increase is caused in young animals by both hypertrophy and hyperplasia (numerical hypertrophy), while in older subjects the increase in size is due to simple hypertrophy of the elements. The convoluted tubules were always enlarged, and the epithelium is thicker and wider than in normal subjects. The relatively slight increase in the size of the parenchyma is conditioned by enlargement of the lumina of the straight tubules without increase in the size of the lining epithelium. No hypertrophy of the connective tissue or capillaries was found.—*Centralbl. f. d. Klin. Med.*

ARTIFICIAL RUBIES.—Mr. Geo. F. Kunz, in *Science*, describes some large artificial rubies submitted to him for examination. The whole structure of the artificial stones is that peculiar to fused masses. The principal distinguishing characteristics between these and the genuine stones is the presence in them of large numbers of spherical bubbles, presenting the same appearance as those seen in glass and other fused mixtures. They are nearly always in wavy groups or cloudy masses. A few enclosed inner bubbles, apparently a double cavity, but empty. In natural rubies the cavities are always angular or crystalline in outline, usually filled with some liquid, and often arranged with the lines of growth. These differences can be easily detected with a pocket lens. In many genuine rubies also is found a silky structure (called "silk" by the jewelers) which, under a 4-10 in. objective, is found to be a series of cruciform or acicular crystals, often iridescent, and arranged parallel with the hexagonal layers of the crystal. When numerous, they produce the asteria or star effect, if the gem is cut *en cabochon* form, with the center of the hexagonal prism on the top of the cabochan. The hardness of these stones was about the same as that of the true ruby: 8.8. The specific gravity was 3.93 to 3.95, the true ruby ranging from 3.98 to 4.01. With the dichroscope the ordinary image was cardinal red, the extraordinary image salmon red, as in the true ruby of the same color. Under the polariscope annular rings were observed. With the spectroscope the ruby red line, like that in the true gem, is seen, although a little nearer the dark end of the spectrum. The color of the stones was good. K. thinks these artificial rubies were produced by fusing an aluminate of lead in connection with silica in a siliceous crucible, the silica uniting with the lead to form lead glass, and liberating alumina, which crystallizes out in the form of corundum in hexagonal plates with a specific gravity of 4.0 to 4.1, and with the hardness and color of the natural ruby, the latter being produced by the addition of some chromium salt.

POLARIZED LIGHT IN EXAMINATION OF THE HAIR.—Dr. J. Pohl-Pincus, of Berlin, has recently published a paper entitled, "Polarized Light as a Means of Recognizing Irritable Conditions of the Nerves of the Scalp." He has prosecuted his studies in this direction for twenty-five years, and announces, as a result of these investigations, that, by an examination of the hair roots by polarized light, peculiar changes may be observed whenever the patient suffers from

physical irritation or mental excitement. He divides the hair bulbs into three groups, viz.: (a) If, in healthy conditions of the body and mind, the hairs that fall out daily are examined microscopically by polarized light, the enlarged bulbous end of the root will show a white contour and a yellowish or brownish-red center. (b) In all irritable conditions of moderate grade, all painful conditions of any organ, also in emotional disturbances of moderate grade without any apparent bodily disease, the bulbous end of the hair-root increases in length and breadth, the central part appears under polarized light of a violet, blue, or bluish-green color, separated from the white contour by bands of yellow and red. (c) In higher grades of bodily disease or mental disturbance, the bulb becomes still larger, and the bluish centre changes to green, yellow, or orange. The main conclusion to be arrived at is that emotional disturbances or bodily disease influence circulation to such an extent as to give rise to changes in the nutrition and pigmentation of the hair.—*Neurological Review*.

NEWS AND NOTES.

THE recorded number of plant-genera of Australia is 2248.

THE *Scientific American* says that insects may be preserved dry for microscopical purposes by dipping them in a solution of corrosive sublimate.

THE histological collection of the Museum of the Royal College of Surgeons of England contains upwards of 12,000 specimens, all arranged and catalogued so as to be readily available for reference. The number of slides in the original Hunterian collection is 215.

F. LYNNWOOD GARRISON contributes to the August *Journal of the Franklin Institute*, a paper on the microscopical structure of car-wheel iron.

M. GALIPPE has related to the Paris Academy of Medicine the discovery of a new fungus composed of tubes and spores of mycelium developed in the human saliva. It belongs to the *Moniliæ* family, and M. Galippe has given it the name of *Monilia sputicola*.

AMONG the papers read at the 59th annual meeting of the Association of German Naturalists was one by Dr. Lehmann on the microscope as an aid to physical investigation.

DR. KARTULIS, of Alexandria, Egypt, claims that the giant *Amœbæ* are the specific cause of dysentery.

THE Massachusetts Board of Health find that the following food stuffs, among others, are especially liable to adulteration. Spices: Addition of starch and other foreign powders. Especially true of pepper and mustard. Cream of tartar: Substitution of starch, gypsum, and other cheaper substances. Baking powders: Alum and other injurious ingredients. Sugar: Glucose, poisonous coloring matter. Coffee: Mixture or substitution of various cheaper substances.—*Scientific American*. In detecting these adulterations the microscope is invaluable.

It is stated that British plants have undergone no changes during the past 300 years. This has been determined by comparing existing plants with the dried specimens in the Sir Hans Sloan herbarium.

ACCORDING to the *English Mechanic*, it is found that timber which has floated in water for some time (raft timber) is no longer liable to dry rot. The water slowly dissolves out the albumen and salts, thus depriving the fungus of the nutriment needful for its development.

BOOK REVIEWS.

ANATOMICAL TECHNOLOGY AS APPLIED TO THE DOMESTIC CAT: AN INTRODUCTION TO HUMAN, VETERINARY, AND COMPARATIVE ANATOMY, by Burt G. Wilder, B. S., M. D., and Simon H. Gage, B. S. Illustrated; second edition, revised. New York and Chicago: A. S. Barnes & Company. pp. 575. 1886.

AN ELEMENTARY COURSE IN PRACTICAL ZOOLOGY, by Buel P. Colton. pp. 185. Boston: D. C. Heath & Co. 1886. Detroit: D. O. Haynes & Company.

The student of zoology or comparative anatomy who can add the above two books to his library is to be congratulated.

Anatomical Technology is already too well known to need commendation from us, and the fact that it is now in its second edition is sufficient indication of its appreciation by both teachers and pupils. The great amount of information, invaluable to the beginner, crowded between its covers is surprising, and could only have emanated from men who for years have noted the needs of students and beginners. The present edition is an improvement on the first in many ways. Besides correcting former errors and bringing its teachings, in accordance with the progress of anatomical knowledge, down to date, some sixteen pages of new matter have been introduced.

We know of no other hand-book of zootomy in the English language which compares with this, and we cordially recommend it to both beginner and adept.

In Practical Zoology, Mr. Colton has attempted to carry the student by means of practical work, from the lower and simpler

forms of animal life to those of a higher and more complicated organization, teaching by outline directions, what to work with, how to work, and more especially, *how to observe*.

The introductory chapter deals with methods of collecting and preserving insects, together with a list of the instruments and materials necessary for the prosecution of the work elucidated in the pages following. One especially commendable feature of Mr. Colton's book is the reference, at the end of each subject, to works having a particular bearing on the matter under discussion.

We are always glad to see these practical helps, believing that, if well done, they will do more towards interesting and instructing beginners than any or all of the text-books extant. Teachers will find Practical Zoology just the book to put into the hands of their first course students.

MODERN PETROGRAPHY, An account of the application of the Microscope to the study of Geology, by George Huntington Williams, associate professor in the John Hopkins University. Boston: D. C. Heath & Co. 1886.

This is the first of a series of essays prepared by specialists which the publishers propose to issue under the title of *Monographs on Education*.

The microscopic study of rocks is, in this country, a comparatively new and uncultivated field in microscopic science, and as such offers rich harvests to earnest workers. Microscopy must become as necessary a hand-maid to geology as it is to zoölogy and botany, and to the microscope we must look to clear up the dark chapters in the history of the earth hidden in its crystalline rocks. The monograph before us gives an excellent introduction to the study.

A MANUAL OF MICROSCOPICAL TECHNOLOGY FOR USE IN THE INVESTIGATIONS OF MEDICINE AND PATHOLOGICAL ANATOMY, by Dr. Carl Friedlander, University of Berlin; translated by Stephen Yates Howell, M. A., M. D. pp. 249. G. P. Putnam's Sons, New York and London; D. O. Haynes & Company, Detroit, Michigan.

Although a different translation of this well known work has appeared, the one under consideration is to be preferred by the American student, as Dr. Howell has added many notes and much material with a view to adapting it more to the wants and present stage of Microscopical Science in this country.

We do not think we exaggerate when we say that this little book is probably the best on the subject. Though possessing all the merits of close and careful thought, so characteristic of the Germans, it is happily free from the exasperating prolixity and expanding of trivial detail so common in their works. All departments of the special Technology are carefully considered: The Microscope, choice and use of; instruments, reagents and stainings used in Microscop-

ical research; the study of bacteria; solid and fluid tissues, etc. The greater portion of the book is devoted to that most important department of Microscopical technique—the use of reagents and preparation of stains. Here will be found all needful data regarding these, and especially as employed in bacteriological investigation. The chapter on bacteria (accompanied by an admirable plate) is one of the most concise and clear that we have seen on the subject. The publishers have presented the volume in most attractive shape. Investigators will find it invaluable in their work.

CORRESPONDENCE AND QUERIES.

Editor Microscope:

Microscopists who keep up an extensive exchange of slides find it rather expensive to pay from \$4 to \$7 per gross. The bulk of the expense involved lies in finishing the edges. Please allow me to suggest an idea gratis, which I hope opticians or glass manufacturers will take hold of, *i. e.*, to stamp or press slides out, from one to five gross in one impression—slides with a nicely beveled edge, straight, flat surface, true to gauge. I believe this process would reduce the cost of slides one-half, if not two-thirds. I have seen articles of glassware stamped out with the nicest perfection. The first expense is the making of the die or mould to press them in, but this should be no obstacle. In nearly all good glassware you will find a quality of glass—white and clear, which I think would make excellent slides—much better than crown glass. Who will act in this matter?

J. D. BECK.

LIBERTY, Pa., Oct. 24, 1886.

M. S. B.—You will have no trouble with the sections embedded in celloidin if you clear them up in oil of origanum rather than that of cloves, as the former causes no curling of the celloidin.

S. P. C.—The trouble with your specimens seems to be that they have been preserved too long in the dilute alcohol, and have undergone putrefactive softening in the interior from being too large for the alcohol to penetrate them. Cut your future specimens into $\frac{1}{2}$ inch cubes and immerse, from the start, in 95 per cent. alcohol.

F. B. S.—Canada balsam is to be preferred to dammarlac as a mounting medium, for not only does it harden more rapidly and firmly, but air bubbles, inadvertently introduced into it, are absorbed or pass out, which is not the case with dammar. Glycerin mounts, however well protected by rings, cannot be looked upon safely as being permanent.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be given ONE INSERTION FREE OF CHARGE. Dealers are referred to our advertising department.

POLLEN and Vegetable slides double stained (new method) 50 cts. each. Slides and formulae of new stains, etc., 75 cts. each. A large variety of pollen, 5 cts. a package.
J. D. BECK, Liberty, Tioga Co., Pa.

WANTED—A Milliamperemeter in exchange for cabinets, slides or cash.
CHAS. BLASDALE, M. D., Jericho, Queen's Co., N. Y.

SLIDES, labels for same and material in exchange for slides.
EUGENE PICKNEY, Dixon, Ill.

WANTED—Microscope of modern make, Bausch & Lomb Investigator preferred. Also Foraminifera Polycystina. Will give fine slides or cash. Diatomaceous clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material.
E. H. RICHARDS, Woburn, Mass.

WANTED—Good Zentmeyer Microscope Stand, Binocular preferred, none but a first-class instrument.
M. DE BALD, 136 Goodall St., Buffalo, N. Y.

FOR EXCHANGE—Living specimens of *Volvox Globator* by mail for other "raw material" or mounted slides. Also one of Queen's dollar sets of untreated diatoms. Polycystines especially desired. ROBT. W. WOOD, JR., Revere St., Jamaica Plain, Mass.

FOR EXCHANGE—Mounted sections of injected lung of guinea pig.
CHAS. BLASDALE, Jericho, Queens Co., N. Y.

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medical books and surgical instruments.
DR. HENRY W. COE, Mandan, Dakota.

FRESH WATER ALGÆ, very numerous species, including *Volvox* in abundance, Desmids of all kinds, *Draparnaldia*, *Rivularia*, *Anabaena* *Tetraspora*, etc., etc.
J. M. ADAMS, Watertown, N. Y.

DIATOMACEOUS Earth from Denver, Col. in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Col.

IHAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms Polycistina, etc., and a variety of other good objects, all well mounted.
W. FARNELL, Macon, Ga.

I WILL exchange good histological for other first class mounts.
S. G. SHANKS, M. D., 547 Clinton Avenue, Albany, N. Y.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Ind.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium having refractive index of 2, 4, can be procured from H. H. CHASE, Geneva, N. Y.

WANTED—Unmounted material of any kind; foraminifera and diatoms preferred; will give good exchange.
M. A. BOOTH, Longmeadow, Mass.

FOR EXCHANGE—Cathcart's ether freezing microtome, complete. Would prefer an injecting syringe.
A. B. AUBERT, Orono, Penobscot Co., Maine.

WANTED—No. 5 of Vol. 2, and No. 1 of Vol. 3. This journal. Who can supply?
D. HUMPHREY, Lawrence, Mass.

FOR EXCHANGE—A new mechanical finger for a copy of Beale or Carpenter; slide of grouped diatoms for French objective, $\frac{1}{4}$ inch in focus.
HAROLD POLWE, 136 High St., Peoria, Ill.

WANTED—Complete or partial set of Woodward's photo-micrographs; also to exchange photo-micrographs of various objects: a list of which will be sent on application.
JAS. B. SHEARER, Cor. Center & Adams Sts., Bay City, Mich.

SELENITE FILMS, neatly mounted and giving a beautiful chromatic display, for use with the polariscope, 25 cts.
R. W. WOOD, JR., Jamaica Plains, Mass.

I WILL exchange algæ, diatomaceous earth, diatoms in situ on algæ (mounted or unmounted) and a variety of miscellaneous slides, for well mounted slides, diatoms and histological slides preferred.
F. L. CANCH, Carpenteria, Santa Barbara Co., Cal.





Witness, John A. Rogers

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 83 Lafayette Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. BOX 583, Detroit, Mich.

No receipt will be sent for subscriptions received unless specially requested.

Specimens for examination should be sent to the *Microscope Laboratory*, 83 Lafayette Avenue, Detroit, Mich. In all cases the transportation charges on these specimens must be prepaid, and special directions for packing and shipping will gladly be sent upon application.

VOL. VII.

DETROIT, FEBRUARY, 1887.

No. 2.

ORIGINAL COMMUNICATIONS.

OBSERVATIONS ON CHÆTONOTUS.

[Concluded.]

DR. ALFRED C. STOKES, TRENTON, N. J.

1. *Chaetonotus (Icthydium) podura*, Ehr.

THE body, according to Ehrenberg, is linear oblong, the anterior extremity swollen, sometimes three-lobed, often slightly constricted, and the posterior end forked. He gives the length as varying from $\frac{1}{4\frac{1}{2}}$ to $\frac{1}{1\frac{1}{4}}$ inch. The few individuals observed by me have the entire cuticular surface smooth and naked, with the exception of the four dorsal hairs already referred to as present in every species, and the two longitudinal bands of ventral cilia. The oral annulus is not beaded. The egg—only one specimen of which I have seen, and this I neglected to measure—was entirely smooth. The individuals in the waters near my home are rather smaller than the largest measurement given by Ehrenberg.

2. *Chaetonotus sulcatus*, sp. nov.—Plate I, fig. 15.

The peculiarity of this form is in the deep, transverse sulcations or furrows, usually conspicuously developed on the back and sides. Rarely they are almost obliterated, or represented by a few low ridges crossing the back transversely. The body is very soft and flexible, and more nearly hyaline than that of any other thus far observed, and the lateral margins, which are often so flattened as to give the body a winged appearance, are beautifully crenated, as is the back also when seen in profile. The posterior

region (Plate I, fig. 15) between the caudal bifurcation and the dorsal convexity, is narrowed and much more prolonged than in any other species, a peculiarity that seems characteristic. On account of it the ovary appears to be unusually far forward, making the oviduct uncommonly long. The oral annulus is not conspicuously beaded. The oesophagus is not more than one-sixth the length of the entire body.

The size varies from $\frac{1}{136}$ to $\frac{1}{237}$ inch. In the small form I have seen an ovarian egg apparently almost ready for extrusion, with the nucleus of another developing egg beside it. The extruded ovum from the small variety, is entirely smooth, and measures $\frac{1}{790}$ inch in length.

This is an *Icthydium*, if the latter is to be considered a valid genus.

3. *Chaetonotus concinnus*, sp. nov.—Plate I, fig. 6.

The body is oblong, and the lateral margins more nearly parallel than in any other observed species. The back and sides are densely covered by small, hemispherical elevations or papillæ, arranged in oblique courses, and giving the animal a peculiarly neat and attractive appearance. The two caudal glands are uncommonly large and conspicuous. The ventral space between the two lateral bands of locomotive cilia is entirely naked. The body is $\frac{1}{265}$ inch long, and the egg, whose surface is smooth, measures $\frac{1}{457}$ inch long.

4. *Chaetonotus Slackiæ*, Gosse.—Plate I, fig. 7.

In this the characteristic part is the head, which is not lobed but in outline (fig. 7) is like the half of a short ellipse, passing with an abrupt angle into the neck, which is rather more slender, in comparison with the body, than in *Ch. larus*, Ehr., which the animal resembles in its general proportions. The upper surface is conspicuously studded with quinquencial dots, this part and the sides being also clothed with very fine hair, of moderate length, and directed backward. The body is $\frac{1}{133}$ inch long. This form I have not seen, and am therefore indebted to its discoverer for these and the following facts.

It was in this species that Mr. Gosse discovered the water-vascular system of the genus. In his specimens there were two tortuous vessels visible on one side of the body-cavity, and one on the other, all distinctly traceable, posteriorly, almost to the caudal bifurcation, and anteriorly into the head, where each ended in a clavate bulb. In the ventral region of the same part there were

two globular, refractive vacuoles not connected with the ends of the vascular bulbs, and one of them eventually disappeared. They may have been contractile vesicles. Plate I, fig. 7, shows the outline of the head of this species.

5. *Chaetonotus gracilis*, Gosse.

The body is, here, long and narrow; the head is somewhat three-angled, with five distinct, rounded lobes, and is abruptly joined to the narrow neck. The œsophagus is very long, extending to the middle of the body, and, just before it enters the intestine, the thick, muscular walls suddenly narrow till they seem commensurate with the tube itself. The hairs on the anterior body-half are set in quincuncial order, and the fine bristles on the back and sides are recurved. This, which I have not seen, would be readily recognized by the very unusual structure of the œsophagus.

6. *Chaetonotus brevis*, Ehr.

Ehrenberg's description of this species, which I have not met with, is:—Body short, oval-oblong, slightly constricted near the enlarged front, having few dorsal hairs, the posterior ones being the longest. The eggs are small. Length $\frac{1}{4\frac{1}{2}}$ inch.

7. *Chaetonotus loricatus*, sp. nov.—Plate II, figs. 16—21;
Plate I, fig. 5.

The entire body, with the exception of the caudal prolongations and the narrow ventral space between the two longitudinal bands of cilia, is covered by imbricated, apparently sub-semicircular scales, their rounded and unattached margins being directed toward the animal's head, or in a direction opposite to that of the scales of a fish, thus giving the body a strange but beautiful appearance. The free margins of these transparent scales seem to be thickened, but this may be illusory, and is omitted from the figure (Plate II, fig. 16). These appendages extend around the lateral borders to the outer edges of the ciliary bands, where they cease. The ventral interspace is naked. In addition to the ventral cilia, there is, on each side of the oral annulus, a tuft of cilia, continuous with the anterior clusters of the tactile hairs (Plate I, fig. 5). They, as well as the tactile bristles, are adcurved, and their function seems to be to create a food-bearing current, while that of the ventral bands is chiefly locomotive. The animal is $\frac{1}{1\frac{1}{3}}$ inch long. Its movements are rapid and erratic when first placed on the slide, but it soon settles down to a comparatively quiet search for food.

The oral aperture is obliquely placed (Plate II, fig. 21), the oral annulus being strongly beaded.

The œsophagus is from one-third to one-fourth the length of the body, the margins of the cavity being minutely and irregularly crenulated. In the mature adult there are often developed conspicuous, temporary, lateral diverticula, or passages of unequal length. (Plate II, fig. 19), which seem to extend from the central into the lateral passages. They are opened and closed at the animal's will, but whether by irregular muscular action, or whether they are normal parts of the organ, I do not know.

A variety is rarely met with which differs from the above form in its smaller body, the fewer and much larger scales, and in the presence of two, long, recurved spines developed on each lateral margin near the posterior extremity. I have observed but a single individual of this variety.

The egg is $\frac{1}{545}$ inch long. One surface and both ends are armed by hollow papillæ, or short, hollow spines, the summits of both papillæ and spines being bifid or emarginate, as in Plate II, fig. 20. The long and short appendages are often present on the same specimen.

8. *Chaetonotus rhomboides*, sp. nov.—Plate II, figs. 31-35.

The characteristics of this previously undescribed species are the unusual form of the head, the small rhombic scales, and the extremely long caudal appendages. The body itself is long and narrow, measuring about $\frac{1}{8}$ inch in length. The posterior extremity is divided into two furcations or branches, each between one-third and one-fourth the length of the entire animal. These taper gradually to their free ends, and are composed of about twenty slightly constricted rings or joints. They are freely movable and flexible, and form tail-like organs, unique so far as this genus of microscopic animals is concerned. At their junction with the posterior extremity of the body they are separated by a more or less conspicuous emargination, as shown in Plate II, fig. 31, where but one of the caudal appendages is delineated. They invariably appear, so far as I have examined different individuals, to be quite hollow and empty. I have been unable to see the duct of the caudal glands; and the muscular apparatus of the part is invisible.

The broad head is formed of three lobes, a frontal and two lateral. The former terminates on each side in a single, acuminate, hook-like process, habitually in close apposition with the anterior lateral region of the lateral lobes, of which the posterior extremities

also terminate each in a single hook-like continuation larger and more conspicuous than the frontal hooks, (Plate II, fig. 35.) The oral annulus is beaded, and the oral cilia project apparently in a tuft. Immediately behind the oral ring is a deep, narrow, transverse sulcation, rather less than one-half as long as the diameter of that part of the head, the former measuring $\frac{1}{1500}$ inch, the latter about $\frac{1}{700}$. It is difficult to conjecture the function of this peculiar feature. The tactile hairs are very long, and there are several additional vibratile setæ on each side of the oral ring which are noticeably straight and stiff, yet movable. The ventral cilia are in two long lateral bands, the intervening space being smooth and naked. Eye-like papillæ were not observed.

The back and sides are completely clothed by a coat of mail composed of transparent, imbricated, rhombic scales, their free and sharply pointed anterior ends being directed forward. They are not more than $\frac{1}{5000}$ inch in length, and when examined under high amplification, present a beautiful appearance. An attempt has been made in Plate II, fig. 32, to show this, but with very moderate success. The lateral margins seem to be thickened, and the posterior border of each scale appears to bear a minute, supplementary, triangular scale. Each of these cuticular appendages is probably shaped as shown in Plate II, fig. 34, its posterior end being truncate, and the arrangement presumably that shown by fig. 33. The thickening of the lateral borders may be due to the slight over-lapping of the transparent scales, but I am at a loss for an explanation as to the cause of the minute but very noticeable triangles.*

The œsophagus is short, rarely exceeding one-sixth of the length of the entire animal. I have observed a water-vascular system in this species, but the two ciliated tubules seen were traced for so short a distance and so incompletely investigated, that I can now only record their undoubted presence.

This interesting creature was quite abundant in the gatherings made while its relatives were being studied, but I have not seen an extruded egg, and have not succeeded in keeping the animal alive long enough in confinement to mature the egg even when an individual has been found with one forming in the ovary. A specimen in the latter condition is not often to be obtained.

9. *Chætonotus maximus*, Ehr.

A form which I have identified with this species is not uncommon here. It is described by its discoverer as a large *Chætonotus*,

*Since this was written an individual has been seen with the margins of the scales somewhat convex.

having the hairs on the back short and of the same length, but unless I have made a mistake in the identification, the cuticular appendages should be called spines, and they are sometimes longer posteriorly than elsewhere. They are often independently curved, and somewhat scattered out of the usual longitudinal arrangement, so that the animal then has an untidy, dishevelled and disreputable appearance. The spines arise by enlarged bases directly from the cuticular surface without the intervention of scales. They are very unevenly furcate, one branch being very small, often scarcely more than a minute linear projection. The oral annulus is beaded. The space between the bands of ventral cilia is densely clothed with short, hispid, recurved setæ, two or more long fine hairs projecting beyond the posterior border. The animal is about $\frac{1}{120}$ inch long. The egg I have not seen.

10. *Chætonotus squamatus*, Duj.

In Dujardin's description, he says that this *Chætonotus* is clothed on the back with short hairs basally enlarged into pointed, regularly imbricated scales. Seen from above, it appears to be covered by them transversely, so as to form seven longitudinal rows, but when examined in profile the scales are seen to be the bases of so many short hairs covering the entire back and even both branches of the posterior bifurcation. I am not sure that any form that has come beneath my notice could be identified with this; certainly none could if in these days of fine objectives Dujardin's statement holds good that the hairs or spines can only be seen when the animal is examined laterally. In a single instance a *Chætonotus* that may have been *Ch. squamatus* was observed momentarily and was lost before it could be properly examined.

11. *Chætonotus latus*, Ehr.—Plate I, fig. 11.

The back and sides are clothed with longitudinal rows of short, conical spines, sometimes, always, according to Ehrenberg's description, longest posteriorly. The oral annulus is not beaded, but the oral cilia project beyond the margin in a single setose series. The arrangement of the ventral cilia varies in different individuals, perhaps in those from different localities. In the majority of those seen by me the cilia are in two longitudinal, lateral bands; in a few cases the entire antero-ventral surface for a space equaling the length of the œsophagus, was entirely ciliated, the cilia being continued as two bands extending to the caudal bifurcation, and as two narrow central lines visible for the same distance. The animal is usually described as having four lines of ventral cilia.

Fernald and Ludwig have both observed an external layer of small cells surrounding the large cells of the intestine, and Ludwig has discovered beneath the posterior part of the intestine a gland which he thinks is the testis. This is conspicuously developed in some individuals; in others it is not apparent. It is shown in Plate II, fig. 11, c. In those observed by me the length of the gland was about $\frac{1}{21\frac{1}{2}}$ inch.

12. *Chaetonotus tessalatus*, Duj.

I have seen only a passing allusion to this form, and have not had access to the original description.

13. *Chaetonotus hystrix*, Metzh.

The dorsal surface is entirely covered by long recurved spines, which are unequally furcate. Those on the central region of the back are the longest. They decrease gradually in length toward each extremity. I have not met with it.

14. *Chaetonotus spinifer*, sp. nov.—Plate II, figs. 23–27.

Among *Lemna* and *Riccia* from a shallow pond I have obtained many specimens of a well-armored *Chaetonotus* about $\frac{1}{130}$ inch long, and having the dorsal and lateral surfaces covered by rounded, imbricated scales, the free margins of which are directed forward as in *Ch. loricatus* and *Ch. rhomboides*. From each scale rises a stout, recurved spine whose distal end is unequally and minutely furcate, the base being enlarged and thickened. The arrangement is shown in fig. 27. The spines do not originate from the centre of the scales but from near the posterior part and between the margins of those laterally contiguous. The furcation here, as elsewhere in this kind of appendage, may be described as made by the addition of a minute spur to a curved and simple spine. It is easily overlooked. The spines are largest and stoutest on the back, decreasing gradually over the neck and head, and rapidly over the posterior parts, while across the dorsal surface immediately in front of the caudal bifurcation there extends a supplementary series of four thorns, which are longer and stouter than those on any other part of the body.

The oral annulus is strongly beaded. The external adoral cilia form a tuft on each side continued across the ventral surface by a somewhat scattered series. The space between the ventral ciliary bands is smooth and naked, except near the posterior extremity where there are five setæ arranged as shown in fig. 23, the most posterior two being obscurely furcate; the others are simple setæ.

The cesophagus has on the posterior part of two of the internal margins a thickening in shape like two opposed braces (fig. 24), the

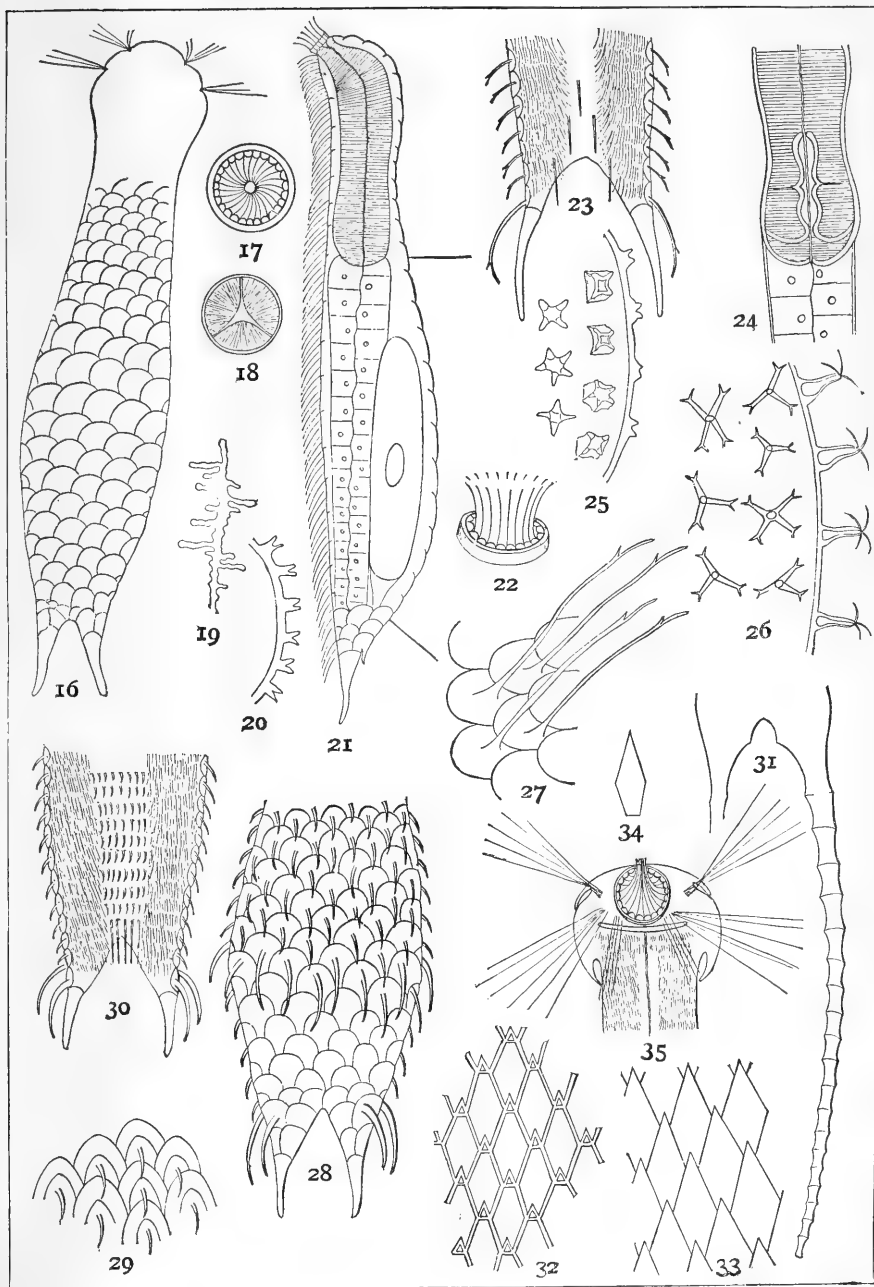
central cusps being long, acuminate, and reaching almost to the external wall, while the posterior ends are continued as outwardly curving prolongations reaching to the same limit. These thickenings are visible only when the *Chaetonotus* is viewed dorsally or ventrally.

The eggs vary somewhat in size, and extensively in ornamentation. Of the last there are three patterns. In one, the side and ends of the egg bear low, stout and hollow processes, whose ends are truncate and four or five parted when viewed from above (fig. 25). Eggs thus armed measured $\frac{1}{345}$ inch in length. In another, the appendages are long, conical, hollow spines whose distal ends are trifid or quadrifid, the branches appearing very fine and delicate when in profile, but from the above the same branches are seen to taper to their ends where each terminates in a widely spreading furcation (fig. 26). These eggs measured $\frac{1}{360}$ inch in length. In the third pattern, one side and the ends of the membrane were covered by an irregular net-work of raised lines, the meshes having four, sometimes five angles, while the opposite side of the egg was rugose with fine, minutely sinuate lines. These eggs were $\frac{1}{320}$ inch long.

15. *Chaetonotus acanthodes*, sp. nov.—Plate II, figs. 28–30.

From a little Sphagnum swamp near my home I have taken in small numbers a *Chaetonotus* measuring $\frac{1}{180}$ inch in length, with the greater part of the cuticular surface wondrously well armed, even the ventral aspect having a protective covering. It possesses both spines and scales, the latter imbricated and their free margins directed forward, each one bearing a small supplementary scale, or scale-like thickening, from which springs a recurved spine (fig. 29). At a short distance behind the body-centre the dorsal surface is traversed by a series of large, stout spines rising obliquely upward and backward, and forming a kind of spinous hedge. On the surface behind this the conical appendages are few and small; very often they are entirely suppressed, except on the lateral margins. On each side near the bifurcation there are two large spines. In fig. 29 the scales are more nearly correct in shape than in fig. 28, where they are too evenly rounded, and where also the appearance of the double scales has been purposely omitted.

The ventral space between the ciliary bands is entirely and closely beset with short, fine, recurved spines or prickles, and five or more long bristles project from the same surface beyond the border of the posterior bifurcation (fig. 30). The egg I have not seen.



16. *Chaetonotus octonarius*, sp. nov.—Plate I, fig. 4.

This is a small and active form, easily recognizable by the arrangement of the recurved dorsal spines. These are unequally furcate, and placed in two lateral longitudinal rows of three thorns each, with one central anterior and one central posterior spine. The species appears to be uncommon. I have met with but a single specimen which I neglected to measure. It needs further study.

17. *Chaetonotus spinosulus*, sp. nov.—Plate I, figs. 2 and 3.

Body $\frac{1}{3\frac{1}{16}}$ inch in length, the cuticular surface granularly rough, and the back usually bearing seven unequally furcate spines in two transverse rows, four spines in the anterior series, three in the posterior. Occasionally the lateral thorns in the posterior row are suppressed, and, in some individuals, the front series contains but three spines. The lateral margins of the body are bordered by short, conical setæ, these being constant in all the specimens observed.

The egg is $\frac{1}{4\frac{1}{50}}$ inch long, and the ends and one side are hispid with short hairs (fig. 3). The embryo escapes in about thirty hours after the egg has been deposited, and in about thirty hours later the young *Chaetonotus* begins to show that the development of an ovarian egg is beginning, and in six hours later the nucleus becomes conspicuous. The extrusion of the egg here referred to was witnessed, and the parent subsequently died. After the escape of the embryo, which I also witnessed, it was hoped that the ovum forming in the ovary of the young animal might proceed to full development and give some inkling as to the method of fertilization. There was but this one *Chaetonotus* in the life-slide, and I had an opportunity not likely to be soon repeated, but before the back began to be arched above the developing ovum, the animal died.

18. *Chaetonotus longispinosus*, sp. nov.—Plate I, figs. 8 and 9.

The unequally furcate spines vary in number from four to eight, the latter being the usual complement. They are nearly one-half the length of the entire animal, and rise from the central region of the dorsum in two transverse rows, commonly of four spines each, and arch upward and backward (fig. 8) to near or beyond the ends of the caudal branches, those forming the most posterior series being the longest. In front of the anterior the surface is setose with a few recurved bristles, as shown in fig. 9, and the body-margins are bordered by a fringe of coarse, stiff setæ. The dorsal spines are always in two rows, but the number varies from four in each to three in one and five in the other. The body is $\frac{1}{3\frac{1}{4}}$ inch in length. The egg was not observed.

19. *Chaetonotus enormis*, sp. nov.—Plate I, fig. 12.

The upper and lateral surfaces of the head and neck are clothed with short recurved prickles, which also extend along the entire ventro-lateral margins of the body. The central and posterior parts of the dorsal region bear thirteen long spines which are posteriorly directed, but only slightly curved. They arise by an enlarged base directly from the cuticular surface without the intervention of scales, and taper to the free extremity near which they are unequally furcate. They are arranged as shown in fig. 12, three spines in the first or most anterior transverse row; four in the next following; two widely separated in the third; three in the fourth, while the fifth series consists of but a single centrally located one. On each side posteriorly are two long, recurved thorns, belonging apparently to the series of small spines that fringe the margins of the body. The animal measures $\frac{1}{300}$ inch in length.

20. *Chaetonotus acanthophorus*, sp. nov.—Plate I, figs. 13 and 14.

The superior surface of the head and neck, and the lateral body margins are ornamented by short recurved prickles, while the dorsal region proper bears four rows of long recurved thorns, each series arching in a forward direction and consisting of five thorns each, with an additional one on each side of the body near the posterior bifurcation. The thorns are minutely and unequally furcate, and arise from an enlarged base (fig. 14), so that the animal is almost completely clothed in an armor formed of the basal enlargements. The oral annulus is not beaded. The egg has not been seen. The body measures $\frac{1}{233}$ inch in length.

The writer recognizes and regrets, more vividly perhaps than the reader, the absence of strict accuracy in his drawings, and their want of artistic expression. The reader will perceive the deficiencies when he meets with the living creatures in their exquisite perfection.

PLATE II.

Figure 16. *Ch. loricatus*, sp. nov.; dorsal aspect; anterior scales omitted.

Figure 17. *Ch. loricatus*, illusory appearance of the oral aperture.

Figure 18. *Ch. loricatus*, transverse optic section of the œsophagus.

Figure 19. *Ch. loricatus*, diverticula within the œsophagus.

Figure 20. *Ch. loricatus*, egg.

Figure 21. *Ch. loricatus*, longitudinal optic section.

- Figure 22. *Ch. loricatus*, oral aperture with projecting oral cilia.
- Figure 23. *Ch. spinifer*, sp. nov.; posterior ventral region.
- Figure 24. *Ch. spinifer*, œsophagus showing brace-shaped thickenings.
- Figures 25 and 26. Eggs of *Ch. spinifer*.
- Figure 27. Spines and scales of *Ch. spinifer*.
- Figure 28. *Ch. acanthodes*, sp. nov.; posterior dorsal aspect.
- Figure 29. *Ch. acanthodes*, appearance of spines and double scales.
- Figure 30. *Ch. acanthodes*, posterior ventral aspect.
- Figure 31. *Ch. rhomboides*, sp. nov.; a caudal branch.
- Figure 32. *Ch. rhomboides*, appearance of rhombic scales.
- Figure 33. *Ch. rhomboides*, probable arrangement of the scales.
- Figure 34. *Ch. rhomboides*, shape of the scales.
- Figure 35. *Ch. rhomboides*, ventral aspect of the head.

USES OF CELLOIDIN.

BY T. B. REDDING, A. M., PH. D., F. R. M. S.

I HAVE been using celloidin, for embedding purposes, for two years past, and find it the best of anything I have ever used for preparing ovaries, fetuses, insects and delicate objects, such as hairs, glands, etc. of plants, where it is desired to make sections of these and retain every part in situ. I usually mount the sections without removing the celloidin.

The celloidin is prepared by dissolving in equal parts of sulphuric ether and absolute alcohol to the desired consistency, and is kept in very closely stoppered bottles. The object is prepared by dehydrating in absolute alcohol, taking the necessary preliminary steps to prevent shrinkage and change of structure.

When the object is thoroughly dehydrated it may be placed in a solution of the celloidin, at once, or, what is better, allow it to remain a few hours or days, according to the nature of the object, in a mixture of two parts absolute alcohol to three parts of ether; then place in the solution of celloidin. First, place in rather a thin solution, and after the object has remained in this till thoroughly saturated, remove it to a thicker solution. If necessary, make such openings and incisions on the object as will allow the celloidin solution to penetrate all parts. Leave the object in the solution until thoroughly saturated. I have objects that have been in the celloidin for over two years, and have never had any injury result from remaining in it so long.

When ready to make sections, remove the object and place upon a cork which will tightly fit the well, or jaws of the microtome, first placing a drop of the thicker solution of celloidin upon the cork previously moistened with a drop or two of absolute alcohol. If sufficient celloidin does not adhere to the object, flow a drop or so over the object upon the cork. Leave it exposed to the air, under a bell-glass until the surface begins to harden slightly. Then invert the cork in a glass tumbler, containing a sufficient depth of 60 to 90 per cent. alcohol; cover, and leave there for 12 to 24 hours, for the celloidin and object to harden. It is now ready for sectioning. Trim off surplus celloidin, put cork into microtome, and cut sections, placing them, as cut, in dilute alcohol of 60 to 90 per cent., where they can remain till ready for staining, etc. If the object has not been stained *en masse*, the sections may be stained in borax carmine, using acid alcohol, in the usual manner, or they may be stained in picrocarmine; neither of these stain the celloidin to any great extent.

The sections may be prepared for mounting in balsam by passing through 96 to 98 per cent. alcohol, or by passing through carbolic acid. I generally use the latter. The sections may be transferred direct from 60 per cent. alcohol into the acid and will clear up beautifully in a few moments, and but few objects are injured or changed by the acid in that time. The sections may then be mounted immediately in balsam, first draining off as much as possible of the acid. Where acid can not be used, without injury, dehydrate with alcohol, not absolute, for that will dissolve the celloidin, but with that of about 96 per cent., and then mount in balsam, or which is often better, mount in glycerine, without dehydrating. If glycerine is used for mounting, it is necessary that the object be prepared in the usual manner by first soaking in various strengths of that material.

Absolute alcohol, ether and clove oil dissolve celloidin. Oil of bergamot may be used to clear sections after dehydrating as above.

I have preparations of insects, chrysalids, plant ovaries, composite and other flowers, and of the human foetus, prepared in the manner indicated above, in which every organ and part is displayed *in situ*; in a preparation of the thorax of the human foetus, about three months old, the lungs, liver, heart, spinal cord and all other parts are beautifully displayed.

It is also very valuable in preparations of the mosses, plant hairs, plant glands and of all delicate appendages, where it is desired to section them and retain every part in place.

Anilin green stains the celloidin a very beautiful green, but if properly used, produces an exquisitely beautiful object and does not interfere with a good view of the tissue and other elements.

In preparing caterpillars, chrysalids, worms, and objects having a hard or impenetrable exterior, it is necessary to make openings so that the celloidin solution may reach the interior and thence penetrate all parts.

In most cases I find celloidin preferable to paraffin, especially where the use of heat is injurious, or not convenient, or where it is important to retain every part in exact place. Sections prepared with celloidin may be transferred at once and fixed upon slide with celloidin and clove oil as a fixing agent, using the usual preliminary precautions, and may then be stained, cleared, etc., as where paraffin is used. One ounce of the celloidin will suffice for a great number of objects.

WILLIAM A. ROGERS, A. M., PH. D.,

PRESIDENT OF THE AMERICAN SOCIETY OF MICROSCOPISTS.

WILLIAM A. ROGERS, the subject of this brief sketch, was born in a small village near New London, Conn., in the year 1832. His early education was acquired in De Ruyter, N. Y., at the De Ruyter Academy. In 1853 he entered an advanced class in the Alfred, N. Y., Academy, from which institution he was graduated in 1854. He then entered the sophomore class of Brown University, pursuing the regular classical course of study until 1857, when he was graduated with the degree of A. M.* The same year he accepted a position as tutor in the Alfred Academy, where, during the year following, he was elected professor of mathematics and astronomy, which chair he occupied for the next thirteen years. During this period he was granted special leave of absence, for the purpose of better qualifying himself in advanced study of the particular branches he had been called upon to teach. One year was passed as a student of theoretical and applied mechanics in the Sheffield Scientific School of Yale College; one year as a special student of astronomy in the Harvard University Observatory, followed by six months' experience as assistant. He was also fourteen months in the U. S. Naval service during the civil war.

While at Alfred, Professor Rogers built an astronomical observ-

*The class of '57 was the last where the students received the degree of *Artium Magister* on graduation. Since that date the Brown University has conferred the usual degree of *Artium Baccalaureus*, in conformity with the general custom of other American colleges.

atory which was well equipped for practical work, containing among other instruments, a clock, a chronograph, and a refracting telescope with nine inch objective. In 1870 he was appointed assistant in the observatory of Harvard University, and in 1877, elected assistant professor of astronomy for a term of five years, on the expiration of which in 1882 he was re-elected. In 1886 he accepted the position of professor of astronomy and physics at Colby University in Waterville, Maine, which last position he now occupies.

The special astronomical work of Professor Rogers while at the Harvard Observatory, has been in observing the position and mapping out all the stars down to the 9th magnitude, in a certain narrow belt of 5 degrees located a little north of our zenith. This work has been done under the auspices of the German Astronomical Society, of which he is a member. Thirteen similar belts were assigned by that society to different observatories throughout the world; two of them to the United States; the one already referred to assigned to Harvard and the other to Albany, N. Y.

The observations of Professor Rogers on this work extended over a period of eleven years, and required fifteen years for their reduction. Four volumes of his observations have already been printed and two more are now in the process of preparation. Though he has severed his official connection with Harvard, he still retains supervision of his unfinished work at the observatory. His last publication relating to astronomy was a "Catalogue of 130 Polar Stars for Epoch of 1875.0." The mathematical problems in this paper were worked out by his able assistant, Miss Anna Winlock, and it may be mentioned in passing, that this is the first time a purely mathematical paper has been published where the work was executed by a woman; Professor Rogers' connection therewith being limited to the methods of discussion adopted, and to an examination of the numerical results obtained.

Interesting as even an outline sketch would be of many of the intricate astronomical problems which have come within the scope of Professor Rogers' observations, of still more interest to the working microscopist are the practical results obtained by him, through years of original research in the broad field of micrometry.

In his early investigations with the transit instrument at Harvard, Professor Rogers found the micrometer spider webs too delicate to be clearly defined with the best illumination possible, in the character of observations he was then engaged in. He therefore began a diligent hunt for a spider whose web was sufficiently coarse to overcome the difficulty. This little incident, trivial as it seems,

was the initial cause of a multitude of subsequent experiments and observations, extending over a period of sixteen years, and which resulted in earning the investigator an enviable reputation, and making him a universally acknowledged authority in all that pertains to micrometrical work.

Being unsuccessful in the spider hunt, he began a series of experiments for the purpose of finding a practical method of etching lines on glass. After many fruitless efforts, the desired result was obtained by making a film on the glass; cutting the lines to be etched through this film, by means of a steel point, and exposing the plate thus prepared to the fumes of hydrofluoric acid confined in a closed vessel. This gave a sharply defined, etched line. A satisfactory production could only be obtained, however, when the confined atmosphere had reached a certain degree of saturation with the acid. An exposure of the glass in an atmosphere below or above the proper standard, yielded inferior or worthless lines. So successful did this method become, in the hands of its originator, that he furnished etched plates under an order from the U. S. government, to be used in photographs taken by the expeditions sent out from this country to observe the transits of Venus.

About this time he also became interested in the construction of comparators for the determination of differences in length, and, by their aid, establishing useful, working standards of measurements for practical mechanical work. In connection with Geo. M. Bond, of Hartford, Conn., Professor Rogers designed and supervised the construction of what is known as the Rogers-Bond Universal Comparator. Two of these instruments were built by the Pratt & Whitney Company of Hartford, one for their own use, and the other the private property of Professor Rogers, used by him in his professional work at Cambridge. It was by means of their comparator that the Pratt and Whitney Company were enabled to establish their well-known system of standard gauges. One great difficulty in working with comparators, before they had reached their present development, was the lack of sufficient and easily controlled illumination for the microscope. This was, finally, overcome by the use of the Tolles opaque illuminator, several of them being made, by their inventor, for Professor Rogers, and found to be thoroughly adapted to his special work; and, at the present day, there is no better, or more convenient, accessory to the microscope, for illumination of opaque objects, under low powers, than this form of illuminator.

In 1880, under the direction, and at the expense of the

American Academy of Arts and Sciences, Professor Rogers visited London and Paris, for the purpose of obtaining authorized copies of the English and French standards of length; the *Imperial yard*, and the *Metre des Archives*. The copies then obtained are the first brought to the United States, and have since been used as the basis of comparison for the bars made by him, which now serve as standards of length for Harvard, Yale, Columbia, Princeton and other colleges; The United States Signal Service and the Lick Observatory; also a combined yard and meter on one bar, constructed for the Department of Standards of the British Board of Trade, to be used in the official determination of the relative lengths of the yard and meter.

The copy of the French meter is a copper bar, which was prepared by Professor Tresca, of the *Conservatoire des Arts et Metiers*, at Paris. It was transferred from meter No. 19, of the conservatory, on February 6th, 1880, at two o'clock in the morning, and later its absolute relation to the original was determined. This bar, now known as the Tresca meter, served as the standard for making "Centimeter A.," which was prepared by the U. S. bureau of weights and measures, for a committee on micrometry, appointed by the American Society of Microscopists, and adopted by that society as its standard of length, at its annual meeting in 1883.*

A comparator recently constructed from the drawings of Professor Rogers, and now used by him in his laboratory at Waterville, possesses several advantages over the Rogers-Bond instrument, and leaves little to be desired. He is at present using this comparator in a series of experiments, undertaken for the purpose of ascertaining the laws which govern the expansion and contraction of different metals under variations of temperature, where their mass is considered. To show the care taken to eliminate possible sources of error in these observations, care and patience typical of all his scientific work, it is only necessary to mention, that in order to obtain the absolute corrections of one of his mercurial thermometers, used in taking the temperature of a metal bar, he made twenty-two thousand comparisons of its scale, with a known standard.

It is his intention to establish at Colby University, a one hundred foot standard of measurement, for the comparison and correction of surveyors' chains, tapes, lines, etc. When this is constructed, it will be the longest standard of length for practical comparisons in the world.

* Proceedings Am. Soc. of Microscopists, 1883, p. 184.

Professor Rogers' micrometer rulings, both on metal and glass, are well known to microscopists for their accuracy as regards divisions, and also for the character and beauty of the lines. His dividing engine with which these rulings are made, the construction of which consumed several years, is a marvel of mechanical skill and ingenuity. It is at present run by a small electric motor, and when once adjusted and started it continues its work of ruling and spacing by automatic arrangements. The lines, which are traced by the edge of a split diamond, are spaced off by means of a large screw, the trifling errors in its thread having been accurately determined.

This screw, which was made by the Waltham Watch Company, necessitated months of experiment. The company was soon able to attain a high limit of precision in the construction of a screw having a working length of nearly four inches, but to make one with a working length of half a meter, was found impossible by any of the ordinary methods of construction and correction. After spending nearly two years in unsuccessful efforts, it was decided to adopt what is known as a sectional screw. Threads were cut from the same part of the leading screw upon ferrules $1\frac{3}{4}$ inches in length, which were afterwards placed on a cylindrical shaft in such a way that the threads of adjacent ferrules would match. The screw as thus completed is undoubtedly the most perfect of its kind ever made.

As an outgrowth of this undertaking we now have what is known as the Rogers-Ballou process, whereby a continuous and practically perfect screw can be cut almost any desired length. A screw made by this process for the dividing engine of Cornell University, was cut and ground in 27 hours from the time the first tracing of a thread was made;* at that time it was found to be perfect for about 20 inches.

Professor Rogers has published over forty monographs on scientific subjects. Among those of peculiar interest to scientific workers with the microscope are "A study of the problem of fine rulings with relation to the limits of naked eye visibility and microscopic resolution;"† "On the conditions of success in the construction of standards of length, and their subdivision into equal parts;"‡ "A study of centimeter A." "A critical study of the action of a § diamond in ruling lines upon glass and metals." ¶

In 1880, Professor Rogers was made a Fellow of the Royal Society of England, and two years ago was elected an Honorary

* Transactions Am. Soc. Mechanical Engineers, Vol. V.

† Am. Monthly Microscopical Journal, 1882, p. 165.

‡ Proc. Am. Soc. of Microscopists, vol. iv. p. 231.

§ Ibid, 1883, p. 184. ¶ Ibid. 1883, p. 149.

Fellow by that body, an honor which has been bestowed on but few. He is also an Hon. Fellow of the Royal Microscopical Society; a Fellow of the American Association for the Advancement of Science, and has twice been its Vice-President at the head of the section of mathematics and astronomy; a member of the German Astronomical Society; a member of the American Academy of Arts and Sciences, whose membership is limited to one hundred; a member of the National Academy of Sciences; also of the Society of Mechanical Engineers. He has been the recipient of the honorary collegiate degrees of A. M., and Ph. D., and at the last annual meeting of the American Society of Microscopists was elected its president.

W. J. L.

PROCEEDINGS OF SOCIETIES.

CENTRAL NEW YORK MICROSCOPICAL CLUB.

SYRACUSE, N. Y., November 30, 1886.

IT is a pleasure to record the first soiree of the Central New York Microscopical Club as a complete success. The entertainment of Nov. 24th awakened new interest in the study of microscopy in this section, and will result in permanent good, and an increase in the ranks of workers here. At the soiree, eighty-five microscopes were in use, showing twice that number of slides, the generous assistance of our neighboring friends enabling us to complete a programme full of interest alike to the general observer and the expert. One of the most interesting features of the entertainment was the stereopticon exhibition by Rev. D. W. Smith, who showed the audience many well-known objects in a new light. The most pleasant feature was the opportunity given of a more intimate acquaintance among workers in this portion of the State, and this fact, coupled with the hearty appreciation shown by Syracuseans, will be a sufficient incentive to make the soiree an annual feature of the club.

Among the visitors who exhibited with us were, W. C. Walker and Dr. M. Cook, of Utica, N. Y.; Dr. R. H. Ward and H. B. Ward, of Troy, N. Y.; Dr. Angell and Adelbert Cronise, of Rochester, N. Y.; and Prof. Wm. G. Crosbie, of Canandaigua, N. Y. Dr. R. D. Nevius, of Olympia, Washington Territory, was fortunately enabled to be present and exhibited many things new to more eastern students.

Last evening our club held its regular monthly meeting in Dr. Robert Aberdien's office. Three names were presented for active

membership. The special entertainment of the evening was a demonstration by Rev. D. W. Smith, of the use of the oxy-hydrogen lime light, as a means of illumination of the microscope. Mr. Smith has devoted considerable time to the effort of producing a light for the illumination of the microscope, which should possess sufficient intensity for the resolution of the finer tests with lenses of moderate powers. Mr. Smith demonstrated before the meeting, last evening, that he could, by using the lime light, resolve, clearly, the lines on certain test diatoms, with an objective which would not show them at all with any other light, no matter how manipulated. This fact is a discovery, the honor of which rests entirely with Mr. Smith, so far as known; and we should be glad to hear something from others who have been experimenting in the same direction. The next meeting will be held on the last Monday in December, when George K. Collins will read a paper entitled, "Diatoms, what they are, and how to see them." WILL H. OLMSTED, *Secretary*.

WELLESLEY COLLEGE MICROSCOPICAL SOCIETY.

THE Society held its first meeting for the year the evening of October 30. It took the form of a conversational and was most enjoyable. Slides were exhibited by some of the members; also certain living objects. The chief feature of the evening was the exhibit of slides presented by Mr. J. D. King, director of the Microscopical department of the summer school at Martha's Vineyard. As specimens of mounting they are unsurpassed, and there was much discussion of his method, and desire to imitate it. Among the exhibits were sections of pine foliage and ferns, showing double staining. There were some beautiful odontifores, some hydroids mounted by a new process, while yet alive, so that they appear as if just from the sea. Some specimens of the crystals of beef fat, presented by Dr. Thomas Taylor of the Agricultural Department at Washington, were exhibited by polarized light, and the consideration of the oleomargarine controversy was reserved for a future meeting. Votes of thanks to the interested friends who had contributed so greatly to the interest and instruction of the evening and to the permanent collections of the Society, were heartily passed.

Friday evening, Nov. 5, the Society tendered a reception to Dr. C. E. West, of Brooklyn, although it must be confessed that the entertainment was furnished by the guest. Dr. West has in his possession a collection of historic and modern microscopical apparatus, which has few equals, and he kindly brought on some rareties to show to the Society. Among these were some mounted objects

prepared by the famous Amici, fifty years ago, also some slides which he himself prepared. He showed a Rogers ruling on gold of the standard inch, a Rogers ruling on steel of the standard decimeter, a Fasoldts ruling of 120,000 lines to the inch. A Roberts ruling, including the famous 19th band. From his histological collection mounted by Prof. Theirsch, some of the most notable among those exhibited where the ovarium of a pheasant entire, the section of a human kidney entire, section of a portion of human brain, and the iris and choroid of the eye of a kid mounted on concave slides, the entire respiratory system of the hydrophillum. This last reminded one of the marvelous tubular bridges of later times. There were also among the exhibits a 500 diatom plate and a 100 diatom plate of Müller. Dr. West at the request of the Society, spoke a few words of his forty years' experience with the microscope, describing some remarkable microscopes of the early, awkward patterns in his possession. Some were specially favored to see a 1.50 objective of Tolles, a consummate work of skill. The evening was one which will ever be in the grateful remembrance of the Society.

The regular monthly meeting of the College Microscopical society took place Saturday, Dec. 4. The President, Miss Ada Wing, was in the chair. After reading of the minutes, certain plans for the future were suggested by Miss Whiting, and adopted by the society. The papers of the evening were upon the "Embryology of the Chick" by Miss Rose Howe, and upon "Recent Studies of Marine Forms" by Miss Barrows. The subject of embryology, so difficult of presentation, was given in a concise, clear and interesting manner. By diagrams, Miss Howe showed the structure of an ovum, and the following early stages in its development:

- (a.) Segmentation of the ovum.
- (b.) The germinal layers.
- (c.) The derivation from these thin layers of the most important organs of the adult form.

Slides were exhibited showing transverse sections of neural canal, notochord, cerebral vesicles, alimentary canal, heart, and organs of sight and hearing. An egg in the fourth day of development was opened, revealing beating heart, arteries and veins and vascular area, gradually enclosing the yolk. Miss Barrows spoke of her summer studies at Annisquam, Mass., and described the habitats, habits and structure of a few of the forms there seen.

Preserved specimens, and the fine collection of glass models in the Zoological museum aided her in making evident to the audience

something of the exquisite beauty of form and color of these inhabitants of the ocean. The following individuals were examined: Of Infusoria, the Ceratium tripos and the Coelenterate colonies, the Hydractinia, Clara, Clitea and Tubularia. The life cycle of the last named, which she had made a particular study, was described. Of the swimming medusae the Obelia, and Oceania, and some of the large jelly fish, were shown. Of Echinoderms, the Asteria, with two of its larval stages, an echinus, a Synapta with a mounted specimen of the perforated plates and anchors, and the Cuvieria taken from a depth of twenty fathoms were shown.

KANSAS CITY MICROSCOPICAL SOCIETY.

ON the 22d of October last, Dr. and Mrs. Tiffany of Kansas City, Mo., held "an evening with the Microscope" at their pleasant home on Tracey avenue. Between thirty and forty ladies and gentlemen were present and with them were several good microscopes. The programme for the evening was as follows:

The Microscope, Flavel B. Tiffany, M. D.; Bacteria, R. R. Hunter, M. D.; Microscopy, E. H. Griffith, F. R. M. S., Fairport, N. Y.; Music, Prof. Krauss; Diatomaceæ, Mrs. F. B. Tiffany; Who Should Work with the Microscope, F. W. Westover, M. D., St. Joseph, Mo.; The Bacillus Song, Mr. Baston; Counting fat globules in Milk; "Awfully nice Philosophy;" Exhibition of Slides.

Before adjournment it was decided to organize a microscopical society, and a committee consisting of Drs. Elston, Dannaker and Tiffany, was appointed to draft a constitution and by-laws to be presented at the next meeting, two weeks from date, at the residence of Dr. Tiffany.

S. O. DAY.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE regular meeting of this society was held at its rooms October 27th, 1886, President Mouser in the chair. The report of the committee on the annual reception was read and adopted. In commenting thereon, Dr. H. H. Harkness said that the exhibition was unsurpassed in three respects,—the quality of the instruments used, skill in illumination, and selection of objects shown.

Numerous additions were made to the Society's library.

Dr. Mouser exhibited a new Zeiss microscope, constructed for biological research. With the instruments, besides others, were two of the recently perfected Apochromatic lenses, of $\frac{1}{12}$ inch and $\frac{1}{18}$ inch focal distance.

At the meeting, November 10th, Mr. J. Z. Davis showed some fine examples of lacunæ in quartz crystals containing fluid and bubbles. Dr. J. H. Stallard spoke on the enormous development of the bile ducts in jaundice, and illustrated his remarks with slides. Mr. Wickson referred to some insects which he had found in large numbers on some laurel trees. It is probable that it is a genus of *Psocus*, but this has not yet been determined, and the insects are now under investigation.

November 24th: Mr. Wickson continued his remarks on the insects of the genus *Psocus*. Specimens of an Australian Polyzoan, *Bicellaria ciliata*, and an Alga, *Trichodesmium*, were shown by Mr. Howard. Prof. Hanks exhibited some remarkably fine examples of insects preserved in amber and in fossil copal.

Dr. Montgomery exhibited a number of interesting slides, illustrative of the minute structure of the eye.

A "Holman Life Slide," containing an unusually rich collection of pond organisms, was shown by Mr. Payzant.

December 8th: Vice-President Wickson occupied the chair, and explained that the meeting had been called for the special purpose of examining the new Zeiss Photomicrographic camera and stand. Dr. Ferrer then briefly described the salient points of the instrument.

After those present had duly inspected the details of the exquisitely finished instrument, a demonstration of its practical working was given by taking a photograph of a stained section of the eye in the embryo of the calf. The plate was given an exposure of eight minutes and, notwithstanding the unfavorable conditions caused by the crowded room, the resulting negative was, upon development, found to be excellent. A number of prints from negatives of other subjects were handed around and were examined with much interest. Several histological preparations were also shown under the microscope, with a novel monochromatic illumination.

December 22: Prof. Runyon, who was present as a visitor, exhibited a number of photo-micrographs made by him with the Walmsley apparatus, and only a common oil lamp as a source of illumination.

William Norris stated that several series of interesting slides had been received by him, which he would turn over to the Society. The first set was composed of diatoms collected and mounted in Australia, by Dr. Thomas Porter, and comprised many rare and beautiful forms. The second lot was from Wm. H. Pratt, Taunton, Mass., and the third from Gerald Stuart, F. R. M. S., London. The latter set consisted of diatoms from New Zealand, and the East

Indies, and was of special interest from the fact that it contained *Navicula Durandii*, a form recently discovered and named in honor of Mr. Durand, who visited the San Francisco Society some months ago on his way to Australia. A. H. BRECKENFELD, *Rec. Sec'y.*

EDITORIAL.

WHAT PRACTICAL USE CAN THE DRUGGIST MAKE OF THE MICROSCOPE ?

THE importance of this query to the practicing pharmacist can hardly be over-estimated. In the first place, it is absolutely essential that the druggist who would know anything of botany and of the plants from which the medicines are made which it is his business to dispense, should have a knowledge of the structure of plant tissues. Prof. Prescott, in a recent valuable article makes this one of the necessary qualifications, also, to an understanding of "the descriptive terms by which vegetable drugs are defined," and "by which to identify drugs in powder." Unfortunately there are in pharmacy, as in other professions, too many to whom the use of the microscope as an educational instrument makes little or no appeal.

There is, however, another side to this question which is of greater interest to the public, and of pecuniary importance to the pharmacist. The retailer may be over-honest, but this has not always been found to be the case with manufacturers and importers, and powders, leaves, roots, etc., for which the highest market price has been paid have often proved to be inert and worse than useless, if not positively injurious to the consumer. Drug adulteration is no new "trick of the trade," for Pliny, Vitruvius and others of the Latin writers, speak of its practice in their day, and of the tests then employed. As the knowledge of medicinal plants increased, the ingenuity of the human brain was taxed to keep pace in this fraudulent practice, until, as early as the thirteenth century, recourse was had to legislation to restrain dealers from cheating each other and the public. At the present time laws are in force in every civilized land prohibiting the adulteration of drugs and food stuffs; but that the evil has not been wholly stamped out in our own country is well-known, and it is asserted that in England, Germany, Belgium and France, there are still establishments which prepare such drugs with especial reference to the American market. In view of these facts, it becomes the imperative duty of every pharmacist to protect himself by testing all crude drugs that come into his possession. And how can this best be done ? Assuredly not by chemistry, which is not

infallible, and which requires both time and apparatus. The simplest way out of the dilemma is afforded by the microscope, which stands ever ready at hand. But little knowledge of technique is necessary, and little time is lost in applying this important test. All that is essential is that a few shreds of tissue torn apart by needles, or a thin slice, or the powdered article be placed on a slide in a drop of water or glycerine under the instrument. Although the pharmacopœias and dispensaries of England and America as yet hardly notice this instrument, its importance as a part of the druggist armamentarium is in this country beginning to be recognized, and at present nearly all our schools of pharmacy include a course of microscopy in their curriculum.

THE demand for mounted slides has been so greatly in excess of what was anticipated, that our stock of several hundred specimens has already been exhausted, and we have not yet been able to fill all orders. All those who have asked for slides, however, will receive them as soon as we can get them out, and we ask for indulgence if we are seemingly slow in so doing. Demands have been made for every variety of object, and some slides asked for would sell for many dollars each. It is quite obvious that we cannot furnish such specimens; and hereafter we must request subscribers to allow us to make the selection, and we will guarantee satisfaction.

We realized that in making this unprecedented offer we were liable to have our hands full, and we are very glad that so many of our friends are availing themselves of it, although, basing our estimates on a former circulation, we are somewhat unprepared for the present "rush." No list of slides will be published.

MR. B. F. QUIMBY, of Chicago, whose universal slide carrier we noticed some time ago, has devised another useful appliance in the shape of an "illuminator" or lamp shade, to be used with the Griffith Club microscope. This consists of three pasteboard cylinders accurately fitted one within the other,—the external revolving on the middle, the inner being removable. All three cylinders are pierced anteriorly by a round aperture; the middle piece having also a slot. With the inner cylinder removed, the external piece may be twisted one way or the other, and the pencil of light coming through the opening thus regulated; or, in the examination of diatoms, the slot may be used. The inner surface of the second cylinder is white, but for the convenience of those who prefer a black background, the inside of the third cylinder is of that color, and this may be slipped into the illuminator whenever a dark surface is required.

The middle cylinder is surrounded at its lower margin with a brass collar to which a short tube is attached. Into this tube fits the lamp rod, while the illuminator rests on the rod controlling the light. It is altogether an ingenious and useful device.

WE notice that the editorial department of the *American Monthly Microscopical Journal* has passed into the hands of Prof. Henry L. Osborn, of Purdue University. Prof. Osborn's well-known qualifications as a scientific teacher make him peculiarly fitted for this position, and we have no doubt that the *Journal* under his management will not only continue to maintain the high standard to which it has been brought through the efforts of Mr. Romyne Hitchcock, but that the coming year will be the most successful and useful yet experienced by this magazine. Mr. Rufus W. Deering, of Washington, D. C., will continue to act as business manager.

JAMES E. REEVES, M. D., of Wheeling, W. Va., has sent us two slides of anthrax bacilli, as found in the liver and kidney of a rabbit, also the lung of a pig having died of the swine plague and a slide of bacillus tuberculosis, all of which are neatly mounted and characteristic of Dr. Reeves' fine work.

FROM Miss M. A. Booth, of Longmeadow, Mass., we have received eight perfectly mounted slides of diatomaceous materials cleanly washed, but not to the extent of destroying their delicate structure; the mounting and remarkable separation of the diatoms adds beauty to the slide—and as they are correctly labeled, the student can study carefully and accurately the diatoms without being confused with the large number of different varieties upon the same slide and under the field. These slides are indeed ideal. Miss Booth furnishes 250 varieties of diatoms from all over the world, and the charge per slide is remarkably low.

WHILE in Cleveland a few days since, we were highly entertained by an examination of the beautiful slides in Prof. A. Y. Moore's rare collections. Among others, we noticed a slide from the lung of Garfield, and one from the brain of Guiteau.

THE MICROSCOPE is indebted to Dr. Taylor for a number of admirable photographs and slides of butter and fat crystals. We presume that many of the former are the illustrations which should have appeared with his paper in the last volume (1885) of the A. S. M. transactions.

Mr. THOS. CHRISTIAN, the discoverer of the diatom *Raphidodiscus Christianii*, has sent us a fine photograph of this interesting object, which is said to be the missing link in the structure of diatoms. *R. Christianii* is disk form, having a navicula centre, meridian line and nodules. Mr. Christian will soon give the history, etc., of the discovery, and a description of this diatom, in THE MICROSCOPE—for which we bespeak many interested readers.

Mr. SCHERMERHORN, President of the Iowa State Dairyman's Association, and himself one of the largest dealers in dairy produce in that State, has recently interested himself in the question of butter tests. In the Iowa State Register of Jan. 10th., he says:—

“In view of the fact that the reliability of butter tests has been brought into question, I furnished to Dr. A. G. Field, of this city, eight packages of butter and mixtures, for microscopical testing. They consisted of various mixtures of lard, salt and butter, butterine, and also pure butter of various ages and modes of manufacture. With the exception of one package of genuine butter, four years old, they all had the appearance of good butter. They were numbered, and the composition of each recorded, but of which Dr. Field knew nothing before making the examination. In every case his report was correct. He stated that he followed the method of Dr. Thomas Taylor, of Washington, D. C., relying principally upon the form of crystal and the use of polarized light.”

This additional testimony to the reliability of Dr. Taylor's methods, coming from a State where butter-making is an important industry, bears with it great weight.

In reply to many inquiries as to the location of Gray's Ferry Road, we quote from a letter of Dr. George A. Koenig: “The locality was opened by a cut of the new Baltimore & Ohio R. R., and is now quite inaccessible, since the cut is throughout lined by a wall, and the bed comes nowhere to an outcrop. Gray's Ferry is on the Schuylkill, within the City of Philadelphia.” See “News and Notes,” Oct., 1886, p. 238.

BOOK REVIEWS.

“THROUGH A MICROSCOPE.” By Samuel Wells, Mary Treat, and F. L. Sargent. pp. 126. The Inter-State Publishing Co., Boston and Chicago; D. O. Haynes & Co., Detroit.

In a first-book of microscopy, the beginner should find the plainest instruction, couched in the simplest language—the very A B C of the subject. Such a book immediately finds favor with the many, and does a service which is both satisfactory and

lasting. In "Through a Microscope," the authors have succeeded in presenting the subject in an interesting and attractive manner, and furnish the beginner with reliable methods in handling and studying objects with which they come in contact in every-day life. Besides telling how to construct a home-made microscope, there are chapters devoted to the examination of drinking-water, plants, and insects, in which the beginner learns how to go to work to "see things," and, what is equally important, how to study them when seen. The book is liberally illustrated.

THE PHARMACEUTICAL ERA, A monthly exponent of Pharmacology, Pharmacognosy, including Chemistry, Microscopy, Botany, and the Art of Pharmacy. A. B. Lyons, M. D., editor; D. O. Haynes & Co., publishers, Detroit.

Although this country is already flooded with pharmaceutical and druggists' journals, the growing importance of this subject make the advent of new publications of this nature both necessary and welcome. This new journal before us proposes to fill a department which has been only partially provided for heretofore, and that mainly by the older Eastern publications. Dr. Lyons, the editor of the *Era*, is too well known both to the medical and the pharmaceutical professions to need an introduction, and as his writings have for years been recognized as authoritative, the readers of his journal are to be congratulated upon the good things in this line in store for them. The first number of the *Era* is handsomely gotten up, printed on good paper from clean type, and is altogether a production of which Michigan may be justly proud. From its diversity of contents, we believe that it will commend itself to every druggist and pharmaceutical chemist throughout the land.

AMERICAN MEDICINAL PLANTS. By F. C. Millspaugh. Published by Boericke & Tafel. New York and Philadelphia. Fascicle V.

Former reviews in this journal have called attention to the excellence of this work. Fascicle V completes the set and fulfils well the promises of the others. Complete, it gives extended and critical illustrations of 150 medicinal plants, each accompanied in the text by full description, history and habitat, part used and preparation, chemical constituents and physiological action. It will prove of great value to the botanist as well as to the physician. The editor and publishers are to be congratulated on its completion and we wish them all the reward they deserve.

DEPARTMENT OF AGRICULTURE REPORT, 1885.

"Dry as a Government report" is a phrase that could hardly be applied to this volume, containing, as it does, so much of interest to the scientist. Our readers would be more especially interested in

the report of Dr. Taylor, microscopist to the Department. Here is found the record of his apparently successful search for means of differentiating the various fats and their crystals with a view to the detection of fraud under the new butter laws. As an endorsement of the valuable work done, Commissioner Colman says: "In consequence of the development of these new facts, two convictions have been made during the past month, by two distinct juries of the Criminal Court of the District of Columbia, for violation of the butter laws." An excellent litho-caustic plate of butter-crystals is attached. The doctor also has articles on "Textile Fibres," "Parasites in Domestic Fowls," "Edible Mushrooms of the United States." This latter is quite exhaustive, and urges the importance of extending our food resource in this direction.

AN EXPERIMENTAL STUDY OF MYCOTIC OR MALIGNANT ULCERATIVE ENDOCARDITIS. T. Mitchell Prudden, M. D: Reprint.

This monograph will give one a good idea of the important work being done in the laboratory of the Alumni Association of the College of Physicians and Surgeons, New York. European schools have long held a monopoly in this class of work, and we are pleased to see such encouraging signs of competition appearing in this country.

WARD'S MICROSCOPICAL SLIDE CATALOGUE.

WE have lately seen a system of cataloguing and describing microscopical slides which was contrived and arranged by Dr. R. H. Ward of Troy, N. Y. The plan grew out of the author's exceptionally long and large experience in microscopy, and has been used in essentially its present form for half a dozen years or more. A combined serial and alphabetical catalogue has been so amplified, without destroying its convenience as a catalogue, as to render it a very complete record of the character and history of the various slides. By entering in the form such memoranda as may be called for in each case, at the time of preparing the slides, the value of any cabinet, whether large or small, will be greatly increased, and much time and trouble will subsequently be saved.

This work has not heretofore been published through the trade, but small editions have been issued by the author at the request of friends who had seen the method in use and who desired to avail themselves of it. The blank forms are issued in books for 1,000 or 2,000 objects; and a few special sets have been prepared in two volumes for cabinets of 4,000 slides, the appendix and alphabetical index being bound separately from the serial list.

MICROBES, FERMENTS AND MOULDS, by E. L. Trouessart. International Scientific Series. 12 mo., cloth, pp. 314, \$1.75. New York: D. Appleton & Co. Detroit: John Macfarlane.

The questions connected with cryptogamic botany and microbial pathology have ceased to belong alone to strictly scientific inquiry. Practical hygiene, domestic economy, agriculture and manufactures must deal with them, and every lawyer, agriculturist, manufacturer and architect must study the functions that microbes fulfill in nature.

In the above work the author has given us a book that contains an excellent account of the morphology and life history of all the parasitic fungi known to science, written in a style intelligible to all.

The introduction discusses the names that have been proposed for the minute organisms that are on the border line between the animal and vegetable kingdoms—the kingdom of Protista, of Haeckel. The author prefers and uses the term *microbe* suggested by Sedellot of Paris, March 11, 1878. We are with him in thinking that this term should be adopted unreservedly into the English as it has been into the French. The word only signifies a small living being and decides nothing as to the animal or vegetable nature of the organisms in question. The word micro-organism is well meaning but cumbersome. The word bacteria is open to the objection that it is the name of a species generalized and applied to an entire group.

The body of the work is filled with material we should like to discuss, did space permit. Chapters I, II and III deal with parasitic fungi, moulds and ferments. Chapters IV to VII with microbes proper. The chapter on the microbic diseases of wine is of especial interest and of great value to the rapidly developing wine industry of this country. The articles upon the microbes of human diseases cover the ground concisely and well. For the general reader it could not be improved. For the physician, as an introduction to the study of the works of Klein, Koch or Sternberg, it is of the greatest value.

Following is a chapter on laboratory technique. The conclusion gives a brief summary of the various theories of the specific diseases, bringing out in relief the great superiority of microbial pathology. The work is profusely illustrated and printed in the usual excellent style of the publishers.

THE Physician's Visiting List, published by Lindsay & Blakiston, Philadelphia, presents the usual essential qualities with many new features and still retains the convenient size that has made it popular.

THE Garner and Science Recorder's Journal, ably edited by A. Ramsey, F. G. S., comes to us each month with a well filled table of contents. It is a popular scientific journal well worthy of support. Subscription 2s. 6d. W. E. Bowers, 25 Wansey street, Walworth Road, S. E., London, Eng.

ENTERTAINMENTS IN CHEMISTRY, EASY LESSONS AND DIRECTIONS FOR SAFE EXPERIMENTS, by Harry W. Tyler, S. B., of the Massachusetts Institute of Technology. Chicago: The Inter-State Publishing Company.

The book has been prepared to show young people something of what chemistry is, and something of how to study it. The experiments are simple and the chemicals and apparatus advised inexpensive. It gives an entertaining glimpse of the laws of chemistry.

MANUAL OF PRACTICAL PHARMACEUTICAL ASSAYING, INCLUDING DETAILS OF THE SIMPLEST AND BEST METHODS OF DETERMINING THE STRENGTH OF CRUDE DRUGS AND GALENICAL PREPARATIONS. DESIGNED ESPECIALLY FOR THE USE OF THE STUDENT AND OF THE PRACTICAL PHARMACIST. By A. B. Lyons, A. M., M. D., F. C. S. Detroit: D. O. Haynes & Company. 1886. pp. 150. Price \$1.25.

This little manual admirably fulfills its purpose, which is to supply the druggist who is not a trained chemist with simple methods of determining the quality of the drugs he handles, requiring neither expensive apparatus nor technical skill. A preliminary chapter is devoted to the simple apparatus required, and another to the special reagents needed, then follows a general discussion of the principles and methods of assaying crude drugs, while the main part of the little volume is taken up with plain specific directions, how to proceed in examining individual drugs, tinctures, etc. We can safely say that it is the best book published in our language on this subject, since it has no rival to share the field; it fills it so well, however, that it has little to fear from any rival. The book is illustrated with wood cuts, and in its typography and general appearance is a credit to its publishers.

SANITARY PROGRESS IN MICHIGAN. By James Hueston, M. D.

Report of progress in our knowledge of Tyrotoxicon by Victor C. Vaughan, M. D., Ph. D., from Proceedings of Michigan State Board of Health, proceedings.

PLAN OF STUDY FOR THE ASSISTANT IN PHARMACY. By A. B. Prescott, Ph. D. Reprint: Proceeding of M. S. P. S., 1886.

THE COLUMBIA BICYCLE CALENDER FOR 1887.

The Pope Manufacturing Co., of Boston, issue a very attractive calendar for the coming year. The back is a well executed chromolithograph representing Thomas Stevens circumbicycling the globe; while the slips for each day in the year give an appropriate quotation, or some information of interest to wheelmen.

CORRESPONDENCE AND QUERIES.

Editor Microscope:

By the courtesy of James W. Queen & Co., of Philadelphia, who recently sent me for examination a Zeiss Apochromatic $\frac{1}{12}$ N. A. 1.40, with a full set of eye-pieces, made from the new optical glass, the members of our State Society have had the opportunity of testing its claims to superiority. By oblique light it is a well-corrected objective, but, in my judgment, no better than our first-class American objectives, except that the images have hardly any perceptible color. With axial illumination, however, using an Abbe condenser of N. A. 1.40, with no stops or diaphragms whatever, the real superiority of the glass becomes apparent. I have never before seen so clear and perfect a picture under similar conditions; and it is clearly apparent that the corrections are approximately perfect up to the extreme limit of its aperture. It is not difficult with such axial illumination to resolve a Möller Probe-Platte from end to end, and the images are practically colorless. In the present state of our knowledge, this objective certainly leaves nothing to be desired. The working distance is large, about $\frac{1}{100}$ inch, and the so-called "searcher eye-pieces" make even as high a power as a $\frac{1}{12}$ very convenient in use. I do not assume to speak for anyone but myself; but such, as it seems to me, must be the judgment of any unbiassed observer. For the practical worker with axial illumination, it seems to me that the Apochromatic objective is destined to become the objective of the future.

Yours truly,

M. D. EWELL.

CHICAGO, January 8, 1887.

S. D. B.—A good method for keeping chloroform-balsam soft under the cover-glass, is to mount in the ordinary way, set aside until the exuded balsam is covered with a delicate film, then spin a ring of gelatin or gum acacia. Over this, after hardening, (which will take but a few minutes,) apply any permanent ring you may desire. If applied to a fresh mount, the rubber cement, of which you speak, would be dissolved by the chloroform. The same can be said of carbon bisulphide. For delicate specimens, however, glycerine is to be preferred to Canada balsam.

Fr. D., Melvin, Ill.—Inquires: Can skins of insects be kept in alcohol for a month or six weeks without over-hardening? Yes.

G. S. A.—A good definition of "numerical aperture" can be found in the *Encyclopaedia Britannica*, ninth edition, page 267, under title "Microscope."

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be given ONE INSERTION FREE OF CHARGE. Dealers are referred to our advertising department.

FOR SALE—A Beck Universal Microscope, with three eye pieces and two objectives, in mahogany case; price twenty dollars. Also a variety of slides for exchange.
E. H. RICHARDS, Woburn, Mass.

FOR SALE—At about one-half cost, a Tolles 1-6 water im. 180°, in perfect condition; or would exchange for a good working stand of recent make, Acme No. 4, Bullock's New Student, or Bausch & Lomb's Physician's, or Investigator. Address X. Y., care of the publishers of this paper.

FOR SALE—A new Zentmayer army microscope stand, binocular—made to order, with complete outfit of accessories. Box 119, Englewood, N. J.

INTERESTING MOUNTS in exchange for meat containing trichina.
H. M. WHEPLEY, St. Louis, Mo.

WANTED—A copy of Phin's "American Journal of Microscopy," No. 1 of Vol. I, for which I will send two well mounted and interesting slides; also one copy each of Nos. 11 and 12 of Vol. VI, for which one slide each is offered. M. S. WIARD, New Britain, Ct.

ECHEIN GREEN—New Stain, to stain from 500 to 1,000 sections, 15 cents; Chrokallos, pink, crimson, orange, and blue, 15 cents each; all sent by mail with directions for use. Pollen for sale or exchange.
J. D. BECK, Box 10, Liberty, Tioga Co., Pa.

HISTOLOGICAL and Pathological Mounts for exchange. Send lists.
J. H. SMITH, M. D., 909 S. Charles St., Baltimore, Md.

FOR EXCHANGE—Histological Mounts.
T. W. JOHNSON, M. D., Danville, Indiana.

FOR EXCHANGE—Mounted Histological and Pathological Sections.
W. C. BORDEN, M. D., U. S. A., Fort Douglas, Utah.

FOR EXCHANGE OR SALE—Mounts of Lepidoptera "Scales," Pollens, Starches, Animal Hairs, and a few Zoophytes.
HERBET M. RICHARDS, Sadsburyville P. O., Chester Co., Pa.

WANTED—Who has a second-hand 1-10 in. hom. im. objective for sale, in good order, Bausch & Lomb, or Beck, preferred.
Address GEORGE H. McCAUSEY, Janesville, Wis.

I WILL EXCHANGE Arachnoidiscus on algæ and diatomaceous earth from different localities in the State; also slides of same for well mounted objects. Diatoms preferred.
F. L. CAUCH, Carpenteria, Santa Barbara Co., Cal.

FOR EXCHANGE—Vols. 4, 5 and 6 of The Microscope, unbound, postpaid. Who will give the most mounted slides? C. A. RAYMOND, Gaston, Washington Co., Ore.

DR. F. P. PECK, of the Iowa Hospital for the Insane at Mt. Pleasant, offers fifty cents for No. 4, Vol. VI., of The Microscope.

FIRST-CLASS DIATOM SLIDES—250 species and deposits, including tests. Also miscellaneous objects, mounted and unmounted, at the lowest possible cash rates. Correspondence invited.
M. A. BOOTH, Longmeadow, Mass.

FOR SALE—A Tolles $\frac{1}{4}$ objective 40° to 70°, adjusting by front lense. In perfect condition.
DAVENPORT FISHER, 110 Huron st., Milwaukee, Wis.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,

At 21 State Street, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 83 Lafayette Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. BOX 583, Detroit, Mich.

No receipt will be sent for subscriptions received unless specially requested.

Specimens for examination should be sent to the *Microscope Laboratory*, 83 Lafayette Avenue, Detroit, Mich. In all cases the transportation charges on these specimens must be prepaid, and special directions for packing and shipping will gladly be sent upon application.

VOL. VII.

DETROIT, MARCH, 1887.

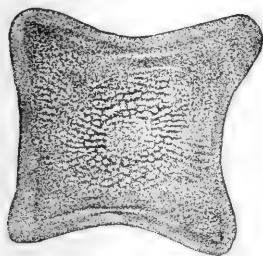
No. 3

ORIGINAL COMMUNICATIONS.

NEW DIATOMACEOUS DEPOSITS.*

THOS. CHRISTIAN.

IN 1885, I had given me about one pound of what at first sight I took to be a fine sand, but which the giver, Rev. Mr. Sturgis, said came from an artesian well at Cambridge, Md., some 200 feet deep, and that it contained some rare diatoms. On a casual examination, I could only find about one diatom to a thousand grains of sand; but as he said that he had washed some, and found a few forms, which he thought were rare, though very few were perfect valves owing to the destructive action of the drill. Wishing to save all the rare forms, if there should be any in the five strata given me, I used only distilled water and my continuous boiling apparatus, by which I can boil days, weeks or months as I may wish. In this case I was from September to November in getting the perfect diatoms entirely free from the sand and fragments, but in a very perfect manner.



Cos. Excavatus. var. Greville.

I was well repaid for all my care and time, as I now have five washings from the different strata, that are said to be the rarest find since the celebrated Santa Monica was sent out. Soon after the material was given me, I found a perfect and beautiful form of *Coscinodiscus excavatus*, (Grev.) which differs from the one described by Greville in having four conspicuous depressions alternating with the same number

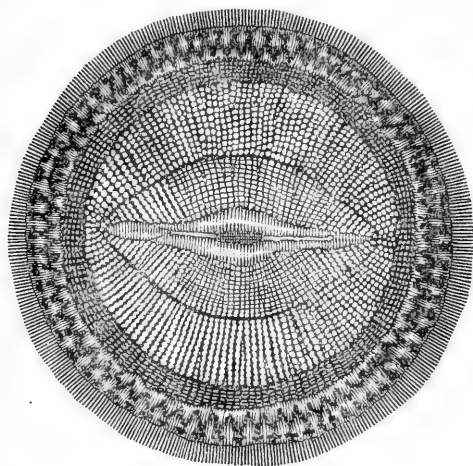
of elevations; the disk is of large size and visible to the naked eye.

* Extract from Paper read before the Richmond Microscopical Society.

As the names for diatoms are gaining so fast, I have called this *Cos. excavatus*, var. *Grevilli*, after the original discoverer.

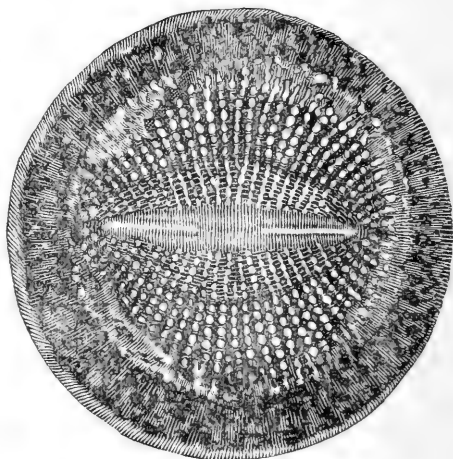
The next diatom to claim my time and attention was a very small disk form having a perfect cellulate marginal rim, the center markings being of a perfect navicular form. Finding but one diatom at

that time I looked it over with care before mounting it, to see if by chance it could be a double frustule, but finding it was not, I mounted it alone on a slide and some time afterwards I sent it to my friend Mr. C. Febiger, for him to photograph and see what he thought of it as a new find. His answer was: "Focus up or focus down, I cannot separate what appears to be a double disk, so I



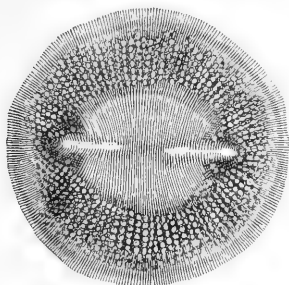
R. Marylandica.

must think it only one frustule." Prof. H. L. Smith to whom I sent a photograph, wrote me March 24: "Photo No. 2 is undoubtedly a navicula, lodged inside another. a melosira—think you will find it a double specimen, two different diatoms." Being very sure that I had a new genus, I wrote him again and he answered as follows: "Am obliged for the photos and am still of the opinion that this one is an accidental combination. No genus of the diatoms will take so anomalous a form. True, this does not prove anything; still there is a harmony of structure in all hitherto discovered that is decidedly against the integrity of this curious thing which you have photographed. If you ever find another, look it over carefully.

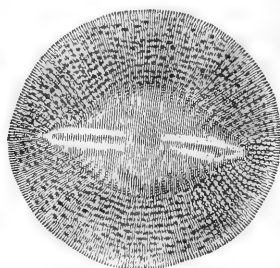


R. Christianii.

Since this was written, Dr. W. J. Gascoyne has found one which has the meridian line more prominent, the markings more distinct, and only about one-half the size of the first one. While trying to find a duplicate to these, I found some ten valves, nearly all badly broken, and which, although they had the distinct feature of this new genus in having the disk form and navicula center, yet were wanting in not having the beautiful marginal rim of the first one discovered, but have a plain, distinct row of cells, which curve over the edge, like the disk of a true *coscinodiscus*, so much so that it is almost impossible to get a perfect photo with the high powers required to bring out the markings. Not a single person to whom I have written and sent photos but has said it must be a double diatom, and the only answer I can give is, how could the broken valves be two



R. Febigerii.



R. Febigerii.

diatoms and yet broken perfectly across both, and this in some ten specimens I have picked and mounted; neither can the highest powers or best objectives separate them, as the markings extend in an unbroken line from center to circumference. One correspondent who has made the diatoms a study for many years, wrote: "This truly can be called the missing link in the structure of diatoms, a disk form with navicula center, meridian line and nodules. This upsets (or confirms, as another high authority wrote) all former theories." I now have three species, and I will leave their placing to those who have made a study of the life history of diatoms. Prof. H. L. Smith kindly gave them a name for me, *Raphidodiscus*, that is, a disk with a cleft or raph, and I have called the first one found *Raphidodiscus Marylandica*, *n. g.*, the one without the rim, *Raphidodiscus Febigerii*, *n. g.*, and Dr. W. J. Gascoyne has named the one found by him *Raphidodiscus Christianii*, *n. g.* I also sent Prof. Smith photos of a square diatom, of which he has written: "I am not sure that I have ever seen this diatom. Its outline is familiar, but the oval interior I cannot recall, neither can I find that it is figured. So far as I know it is new, and I would suggest the name of *Amphitetras* (*Piddulithia*) *Altamans*, *n. g.*"

I have also found what is thought to be a new *Auliscus*, which has been named *Auliscus spinosus*, *n. s.* from the two spines on its disk. Disk with strongly marked lines radiating inward, which join a well defined inner rim, enclosing a center with interrupted striae,



Auliscus, N. S.

giving it the appearance of points. I have mounted one slide with sixteen *Raphidodiscus*. I have some fifteen other forms of diatoms which I have not yet placed or named, and some may be new, as I cannot place them, or the correspondents who have seen them, for study. One noticeable feature is that there are to be seen specimens of well-known forms which vary from the standard types just a little. This deposit has as yet been

only partially examined, and yet we have over one hundred forms from the following genera: *Actinocyclus*, *Actinoptychus*, *Auliscus*, *Amphitetras*, *Asterolampra*, *Asteromphalus*, *Euodia*, *Chaetoceros*, *Biddulphia*, *Aulacodiscus*, *Coscinodiscus*, *Pleurosigma*, *Eupodiscus*, *Heliopelta*, *Hyalodiscus*, *Melosira*, *Raphoneis*, *Navicula*, *Podosira*, *Triceratium*, *Sceptroneis*, *Pyxilla*, *Grammatophora*, *Rhizosolenia*, *Stephanogonia*, *Mastigonia*, *Stephanopyxis*, *Raphidodiscus*, new genus, *Encampia*, *Craspedodiscus*, and several which I have not yet been able to place. I have mounted a few of the rare forms, as well as general slides from this deposit.

I have from a country well some forty miles from Richmond a new deposit which as yet I have only partially examined, but I find it entirely new and distinct from any Maryland or Virginia deposits I have ever seen, the one predominant form being *Craspedodiscus*, of which there are six new species, with from three rows of cells in the rims up to ten or twelve rows, and all different from those figured in Schmidt's *Atlas* Plate 66.

RAPHIDODISCUS N. G.

Frustules disciform, with more or less of a well marked (cellulate) marginal rim, center naviculoid, with interrupted meridian line and radiate (moniliform) striae, which are prolonged to the margin of the disk.

Raphidodiscus Marylandica, N. G.—Thos. Christian.

Raphidodiscus Febigerii, N. G.—Thos. Christian.

Raphidodiscus Christianii, N. G.—W. J. Gascoyne.

NEW METHODS IN DOUBLE STAINING.

J. D. BECK.

UNDOUBTEDLY many microscopists as well as myself have met with difficulties in double-staining animal and vegetable sections or specimens, viz: That when sections were beautifully double-stained with iodine or cerrulin green and carmine, and hardly dehydrated, the green stain would be nearly or totally obliterated or washed out by the absolute alcohol. The ammonia or acid carmine stains having too much ammonia or acid, also remove a certain portion of the green stain, unless the section has a strong affinity for the stain. I have also known the essential oils to remove or bleach out what little was left of the green stain in the specimen. Thus the green stained section goes through three special processes, each one inclined to remove the green stain, viz: first, staining in carmine; second, dehydrating sections; third, clarifying in essential oils. Tannic acid was recommended as a mordant to fix the stain. I tried it moderately strong. It fixed the stain and also fixed the sections as useless. After diluting it with distilled water, alcohol, etc., separately, until it lost all its mordant properties, it continued to *precipitate* the carmine (and thus ruin sections) until its strength was reduced to 300 or 400 times with distilled water or alcohol. I found it the greatest nuisance in the laboratory.

I experimented with a large variety of chemicals, metallic salts, acids, etc., without reaching satisfactory results. Finally I prepared an acid green dye (Echein green), but this also precipitated the carmine. Then I prepared some more stains, (chrokallus,) pink, crimson, orange and blue.

I found those stains to work admirably in many specimens, but I found that some plant sections (nasturtiums, etc.,) did not hold the pink stain permanently, and that the crimson would mix too much with the blue or Echein green in some sections, and did not differentiate so admirably as the pink, but was much more permanent—as much so as carmine. For some purposes I prefer the crimson to the other red stains, when it differentiates beautifully. The blue and red stains, blue and orange stains work well on some sections. I considered carmine a stain too valuable to abandon entirely, and so I repeated my experiments with Echein green and carmine, and met with splendid results.

THE PROCESS.

The process is simply as follows: First, stain the sections well in Echein green, which takes from five seconds to ten minutes.*

*The time varies very much in various plants or tissues, depending on the affinity of tissues for stains.

Second, wash them in warm, distilled water or lightly boiled rain water, filtered and clean, from 150° F. to boiling, if sections will bear it—most of them do—say from two to twenty minutes, depending on the temperature of the water, when the sections can be stained in carmine. I prefer the ammonia carmine. When time allows, the sections can be soaked in cold water from ten minutes to one hour, or they may be dipped in cold water and dropped into two grades of alcohol, first into say 60 per cent. several minutes, and then into 95 per cent. alcohol to hasten the process, and then dipped into water one or two minutes before staining in carmine.

TESTING SECTIONS.

One way to test them is as follows: Lay several washed sections on a slide and let the water (warm preferred) drop on your tongue. If you cannot detect any sour or acid taste they may be considered ready for the carmine stain. The safest way to test them is to let the water drop from a section on to a clean slide and apply a little carmine to it and examine under a one or one-half inch objective, and if no precipitation of the carmine stain is visible, you are safe to stain them in carmine. Surest way, of course, is to test every section one by one before dropping into carmine. I never stain more than from one to six sections at a time, as the same kind of sections don't all work alike, and sometimes finish them on a slide (used for that purpose) and examine them until satisfactory. I have found the Echein green able to resist, in most of sections, the action of absolute alcohol and essential oils. When the Echein green fades in the process I stain them as deeply as possible in the Echein green stain. I have found this sufficient in nearly every instance. When sections are stained too deeply, let them remain longer in the absolute alcohol. This, with some exceptions, generally reduces the color to the desired shade. Some plant, or wood sections, have such a strong affinity for green stains that, when over-stained, the alcohol cannot, in the least, reduce it to a lighter shade. I have saved such sections (when I had no others) by dropping them in a weak alkaline solution of ammonia, etc., a short time, which removed the excess of color. If this solution is a trifle too strong, it ruins plant or wood sections, especially delicate ones. Sections treated in this manner must be soaked in distilled water or alcohol until all traces of the alkali is removed, or it will fade the green stain.

Ammonia carmine too frequently has too much ammonia in it. In such cases the cork should be removed and a piece of fine cambric tied over the mouth of the bottle to keep the dust out and to allow the excess of ammonia to escape, say from two days to a week. I left

a bottle of ammonia in this way fifteen days in a warm room, and find it much improved. The stain or color has a mild and beautiful shade, not so harsh on the eyes as the more flashy, blazing colors, while the vegetable cells retain their natural form. Stains having too much ammonia or acid contract, distort and shrink the vegetable cells more or less out of their natural form, especially delicate sections, and cut them so that they are too frail to handle with the greatest of care, and are useless as specimens for scientific purposes. This is a test for stains when they have too much ammonia or strong acid. The latter can be improved by adding ammonia carmine to it, which has been deprived of an excess of ammonia until the acid in the stain is sufficiently diluted with the aqueous solution of ammonia carmine.

When sections have a very feeble affinity for green stains, I have mounted sections in an aqueous mounting medium, made as follows:

A syrup of white sugar, filtered, 1 oz.; from ten to thirty drops of pure glycerine. Mix thoroughly. The glycerine is added to prevent the sugar crystalizing and getting brittle and flinty. The section when stained is clarified in pure glycerine, and surplus washed off with water, and the latter evaporated and then mounted in the syrup. I have some nice mounts made in this way. To avoid bubbles, the syrup should not be very thick.

THE STRUCTURE OF TEETH.

C. H. STOWELL, M. D.

IN the September number of this journal is an article from me on the structure of the human tooth. I now believe there are some errors in my statements as given on page 196.

I am convinced that the dentinal fibres are true processes from the odontoblasts, and that the processes from the deeper cells do *not* enter the dentinal canals. I further believe that these odontoblasts are concerned, as stated before, in the formation of the dentinal matrix; and that they are capable of transmitting nerve impulses. These odontoblasts are in direct union, or contact, with nerve fibrils. The odontoblasts, with their processes—the dentinal fibres—are therefore, physiologically speaking, the endings of the dental nerves. In brief, the correction I wish to make, is that the dentinal fibres are processes of the odontoblasts—Klein notwithstanding; and that the dentinal canals contain only their lining membrane, and the processes from the odontoblasts. These processes do not quite fill the canals: there is room for a flow of lymph around them, corresponding in this regard to the lymph, canalicular system of cartilage and bone.

THE PATHOLOGICAL CELL.

GEO. DUFFIELD, M. D.

Professor of Physiology, Detroit College of Medicine.

OF all things mysterious in the animal economy none is so strange as the remarkable development and death of cells. Each human body is but the aggregation of cells developed from a single primary cell, the *Ovum*. The cells of the body have peculiar functions, differing according to their position, but essentially dependent upon the circulating fluid—the blood—which supplies the peculiar force whereby osmosis and endosmosis, the true function of cells, take place.

In this short paper it will be my object to speak of the cell that is undergoing some degeneration, some change from the normal, and which is called the pathological cell.

Certain wise men tell us “that every cell in the human body is changed once during seven years.” Be this as it may, though unconscious of it, we are made aware of the truth of this statement. The fact remains that cells do change and that parts most exposed are constantly the seat of such changes. Epithelial cells are being constantly thrown off from the body in the various secretions, their places being filled again by others. The question naturally arises, if these cells are diseased, how are they changed?

In speaking of cells and their changes, we must consider each cell as an independent organism, the seat of nutrition, containing the active principle of life. Any variation from the normal will give us a change differing from the normal, and hence a form of degeneration.

The first change that is liable to occur in cells is fatty infiltration. This division will not include cells that have for their function the secretion of fat, but cells that should perform other functions and have become diseased; this change proceeds from without inwards: it does not originate in the cell itself. Take for example the epithelial layer on the villi of the small intestines. The emulsions destined to be absorbed by the blood and lacteal vessels must first pass through the cells lining the villi. When the fat accumulates in the cell, during the process of osmosis, taking the place of the protoplasm, the function of such cells is lost, and to all appearances the cell is destroyed. Such changes occur in cells of the liver, spleen and kidneys and will cause a softening and weakening of the tissues. Yet, we are told that if the cell can be cleared of the fat it will go on performing its normal functions.

FIXING SECTIONS.

H. E. SUMMERS, CORNELL UNIVERSITY.

THE method of fixing sections to the slide, as given by me in THE MICROSCOPE for March, 1886, has been found to be needlessly complicated when used for celloidin sections. The following simpler method is recommended.

Place the sections in 95 per cent. alcohol for a minute or two, arrange on the slide, drain off the superfluous alcohol by tipping the slide, and then pour over the sections sulphuric ether *vapor*, from a bottle partly full of liquid ether. The celloidin will immediately soften and become perfectly transparent. Place the slide in 80 per cent. alcohol, or even directly into 95 per cent. if desired. The sections will be found to be firmly fixed and may then be stained, cleared, etc.

PROCEEDINGS OF SOCIETIES.

THE KANSAS CITY SOCIETY OF MICROSCOPISTS.

THE monthly meeting of the society was held Feb. 9th, Dr. F. B. Tiffany presiding.

Dr. J. H. Duncan gave an address upon "The Hair," tracing its development from the hair follicle to its completed growth and gray old age. Numerous mounted specimens were exhibited by means of the microscope and stereopticon.

Dr. Le Roy Dibble read a paper on "The Cell," giving the history of investigation upon this subject, and illustrated the typical forms of cells by specimens personally prepared.

The working spirit of the society is growing.

Topics for March 9th are: "Fungi," by Mrs. O. E. F. Tiffany, and "The Microbe," by Mr. L. G. Shepard.

F. A. HOLTON, *Secretary*.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE regular semi-monthly meeting of this society of microscopists was held January 12, at their rooms 120 Sutter street, Dr. Mouser in the chair.

Mr. Howard reported that the sample of supposed diatomaceous material from Arizona, which was recently referred to him for examination, had proved very refractory, and had so far resisted all his efforts to separate out the contained organisms. Quite a discussion

ensued as to the most successful methods of treating refractory earths.

Dr. Stallard called attention to the recently published accounts of the investigations by the microscopist of the local Board of Health with reference to the finding of *Bacillus tuberculosis* in milk supplied by certain dairies in this city. As the subject was one of great practical importance, and as the official named had expressed his willingness to confer with the society in the matter, it was decided to appoint a committee for the purpose of examining the subject, and Drs. Stallard, Ferrer and Mouser were designated as members of such committee.

Prof. Edward S. Holden, the eminent astronomer and President of the University of California, was unanimously elected an honorary member of the society.

Among the objects exhibited was a handsome mount by Thomas Clarke, Birmingham, England, of the rare and beautiful crustacean *Leptodora hyalina*. Until a few years ago it had not been found in Great Britain and its first discovery there created considerable interest. It was found swimming among masses of a minute alga (*Clathrocystis aeruginosa*). Mr. Breckenfeld stated that some three years ago a small pond or reservoir in the Presidio contained the same alga in such prodigious quantities as to give the water the appearance of thick, green paint. Knowing this to be a habitat of *Leptodora*, he had specially searched for that organism, but without success. After some months the immense masses of *Clathrocystis* disappeared, and, strange to say, had not again been seen up to the present time.

January 26. Dr. S. M. Mouser presided. D. W. Parkhurst of this city was elected a resident member.

Dr. Stallard reported from the committee, to which was referred the investigation of the alleged finding of *Bacillus tuberculosis* in milk supplied by dairies of this city. He stated that several conferences had been held by the individual members of the committee with the Microscopist of the Board of Health, but owing to the amount of work and time necessary for the full investigation of the subject, a complete report could not be presented. He was of the opinion that the method of Ehrlich, used in the preparation of the slides of milk submitted to the committee, would have to be modified, as while it was perfectly successful when applied to slides of sputum, its results were not so satisfactory for determining *Bacilli* in milk, owing, probably, to the fact that the oily matter in the latter interfered with the proper color reaction of the contained organisms. In

this view the other members of the committee emphatically concurred.

With reference to the actual finding of tubercle-bacilli in the slides submitted to the committee, the experience of the individual members was somewhat different. Dr. Mouser stated that after a patient search of some two hours, using a Zeiss oil-immersion 1-18 inch objective, he did not come across any undoubted specimens of the sought-for bacillus. Dr. Stallard, who used a Powell and Lealand 1-12 inch objective (homogenous immersion) had the same experience. The third member of the committee, Dr. Henry Ferrer, after a protracted search with his Zeiss objectives, succeeded in finding two undoubted specimens of *Bacillus tuberculosis*. A more extended report will be filed by the committee at a subsequent meeting.

As the subject is one of great importance. Dr. Ferrer gave an interesting résumé of the late researches of Dr. Bang on "Udder-tuberculosis and Tuberculous Milk." During the winter of 1884 this observer examined some thirteen cows affected with udder-tuberculosis in various dairies and slaughter-houses in Copenhagen. The characteristics of the disease were minutely described, so as to be of service in diagnosis. Although the udders of the infected animals soon became greatly swollen, yet the milk continues for awhile to appear perfectly normal. This is a fact of great importance, for during this stage the milk is liable to be still used as nourishment and can thus be the cause of infection in man. Bang found that the milk of tuberculous cows contain *Bacilli*, often in very large numbers, and usually bearing spores. In the course of his experiments he fed three rabbits and five Guinea pigs with such milk and all soon died from tuberculosis. Analysis of tuberculous milk showed that in the course of the disease the amount of albuminous compounds increased, while the fat and sugar of milk diminished.

Mr. Howard exhibited a slide of *Enteromorpha intestinalis* (an alga growing both in salt and fresh water), with several specimens of attached marine *Vorticellæ*, both social and solitary forms.

The State Mining Bureau asked for a report on a sample of diatomaceous earth found on the beach near Santa Monica, and said to be nearly, if not quite equal to the celebrated fragment found near the same locality some years ago. The specimen was referred to Mr. Norris and Mr. Howard for examination.

A. H. BRECKENFELD, *Secretary*.

ELEMENTARY DEPARTMENT.

In the course of conversation with a gentleman, a recognized expert microscopist, whose business leads him to all parts of the country, we found much interest in an account of the extent and character of study of microscopical science as existing in the United States to-day. From him was learned that the general growth, though encouraging, is not great. The cause of this state of things was attributed principally to the lack of thoroughly competent teachers. Even in some of the larger cities, though the seat of colleges, it is oftentimes next to impossible to get good instruction in this important and ever-developing science.

The only resort remaining then, is the text-book, and although there are many most excellent ones, few of them are of benefit unless used under a good instructor. Then again, many do not possess text-books, and, for reasons best known to themselves, will not buy them. These circumstances, as well as hints received from subscribers, have led the editors to the idea that a series of lessons on practical, elementary work, would be of value to many readers.

The lessons will be based on actual laboratory work, and will attempt to place before the beginner, in the *most elementary and primer-like manner*, the details of microscopical technique. No qualification other than the possession of a microscope and an average intelligence will be taken for granted. It is hoped that in this way many, who have hitherto failed or have not begun at all, will be led to comparative if not complete success. And if, at any time, any interested reader do not *thoroughly* understand, or if he entirely or *even partially* fail in the working of a lesson, it is requested that he communicate with the laboratory of THE MICROSCOPE, explaining the difficulties of his situation. Where every error, however slight, is magnified, any wrong procedure, though, at the time, it may seem to "do," will end in ultimate disaster.

For the reason that, in presenting these lessons, simplicity in style is much to be desired, only the essential and best approved methods will be employed. Multiplication of methods leads but to confusion, particularly if the beginner believe each one as of paramount importance. It will surprise many to learn how few of these methods are worthy of serious consideration. Many are worthless, some of them are transitional stages to more perfect states and others again are good, but no better than the old ones we are used to. But they all look well in encyclopedias and all serve to the ultimate advancement of the science.

It is not to be assumed, however, that methods not given are to be considered worthless. Many, more difficult of execution, will be brought in later on as a sort of an appendix, and many others will not be given at all. For it will not be the object of these papers to produce experts, but merely to lead to an intelligent and working knowledge of *essential* microscopical technology. To further simplify matters, instruments and reagents will only be described as needed; thus allowing familiarity with a few before others are introduced.

FIRST LESSON.

“CLEANLINESS IS AKIN TO GODLINESS.”

IN order to obtain material for future work, the art of preserving and hardening tissues will be the subject of this lesson. Animal tissues will alone be dealt with, as their manipulation offers greater variety and practice of technique.

The following materials and instruments will be required: 1. Some animal; 2. A dozen 6-8 oz. jars or wide-mouthed bottles and $\frac{1}{2}$ doz. small bottles; 3. A scalpel, scissors and pair of forceps; 4. $\frac{1}{2}$ gal. 97 per cent. alcohol; 5. 1 gal. of Müller's fluid.

To particularize somewhat: 1. A cat, rabbit or dog will do. For the study of cells, lower animal forms—preferably the batrachia—are to be chosen, as the arrangement is simple and the cells comparatively large. But for more complete examples of structure, the cat can be recommended, not only for the acknowledged superabundance of its kind, but the general excellence of its anatomical parts. A full-grown, male animal should be selected. It might be said here that physicians should save the pathological specimens obtained from post-mortem and operating table, and should utilize the opportunities of an amputation or autopsy to procure normal human tissues. 2. Jars are to be preferred, and should be provided with carefully fitted glass covers to prevent the evaporation of hardening fluid. The small bottles for more delicate tissues, should be 1 oz. in capacity, wide-mouthed and glass-stoppered. 3. Scalpel with a cutting surface 2 inches in length, narrow blade and good point. Do not get the fat-bladed variety, as they will be found very clumsy in delicate work. Scissors should have the hinge nearly in the middle, a cutting surface about 2 inches in length and sharp point. Forceps, 4-5 inches long, closely adjusted teeth, tapered point and soft spring. This latter quality is indispensable. They, who can afford it, will find it convenient to have a duplicate set, several sizes larger, although the instruments above described will, with care, do

much of the coarser work. 4. Dilute alcohol will *not* do. It should have a strength of from 97–98 per cent, which, by the way, will answer for all histological purposes. If the dilute article is needed it can be made by adding distilled water to the stronger alcohol. The formula for Müller's Fluid is: Bichromate of potash, 2 parts; sulphate of soda, 1 part; water, 100 parts. Rub the potash and soda together, warm the water and add gradually, stirring till the salts are dissolved.

See now that the jars and bottles are thoroughly cleansed and dried. In the bottom of each place an even layer of absorbent cotton, say $\frac{1}{2}$ inch in depth. This is done in order that the hardening fluid may reach the under surfaces of the specimens lying on the bottom. If this is not done specimens will oftentimes be found that have become softened and consequently ruined. Now fill several of the jars about $\frac{3}{4}$ full with *undiluted* alcohol, and two or three with the Müller's fluid, and they are ready for the reception of the specimens.

It should be stated here that the process of first immersing the specimen in dilute alcohol, recommended by most authorities, cannot be advised. Alcohol hardens the material by (1) withdrawing the water from it, and (2) coagulating the contained albuminates. It was, and is yet, assumed that if stronger alcohol be used from the first, the specimen would contract so rapidly as to amount to violence, and thus the various elements much distorted and displaced. This, we believe, is a fallacy. A specimen hardened slowly will be found (if not partially macerated) in exactly the same condition as one hardened rapidly. By the latter method we not only eliminate the danger of losing the specimen through maceration, but we avoid the tedious and expensive necessity of changing the alcohol several times.

Having procured a cat or other animal, fasten it to a narrow table in the following manner: Take a piece of stout twine and make a loop around a hind leg. Pass the twine under the table and, bringing it up on the other side, loop the second leg. The animal can be kept quiet during this time by setting it on the haunches. Before it is put on the back make loops around the forelegs and then press the animal back, at the same time tightening the anterior cord by drawing on it under the table. Any unexpected moves (and these are likely to be many if a cat is concerned) should be met quickly and firmly.

Have ready a paper cone, containing a sponge saturated with chloroform. When the animal is well-fixed, clap this over the nose and press down firmly. Watch the respiration carefully, for chloroform kills these animals quickly. When anaesthesia is complete, and before death, make a longitudinal incision over the sternum, and

with the fingers, peel back the skin till the sternal cartilages are reached. Incise these from below upwards, turn back the sternum, uncover the heart and draw it out. Invert the animal over a bucket, grasp the heart lightly at the base, cut off the apex and allow the blood to drain away. All this should be done quickly, in order that the animal die from exsanguination rather than from chloroform narcosis. It does not matter much if the animal happen to die before the finish, as much blood can be drained off before coagulation sets in.

When the hemorrhage has ceased, place the animal on its back and prolong to the pubes the incision first made.

Whilst the animal is cooling the time can be employed in making "stretchers" for the reception of certain specimens. This is done as follows: Take three or four pieces of hard wood about $1\frac{1}{2}$ inches long, $\frac{3}{4}$ inch wide, and $\frac{1}{2}$ an inch thick. On the long, upper side cut a notch the entire width, $\frac{1}{2}$ the depth, and to $\frac{1}{4}$ of an inch of either end of the block, in length. On the bottom, at one end, cut Roman numerals for the purpose of identification. Procure small pieces of lead, flatten them and tack to the middle of the bottom. These should be only large enough to sink the block in alcohol.

Now remove and preserve the parts and organs of the animal in this manner and order: (1) The lungs with the lower portion of trachea, and (2) the heart with several inches of aorta and vena cava; separate the heart from the vessels, open the cavities and cut out two or three pieces 1 inch square from the walls. Divide the vessels into pieces $\frac{1}{2}$ inch in length, wash, by waving gently to and fro in a vessel of water, and drop them, together with the heart portions, into alcohol. The jar should now be labeled. If it is desired to make more sure of the identity of different tissues in the same bottle, a good plan is to run, by means of a needle, small pieces of colored worsteds through the specimens. These, with the specimen to which they are attached, can then be recorded in a book to be kept for the purpose. The lung, to be satisfactorily hardened, should be injected, through the trachea, with Müller's fluid and then suspended in a large jar. Small specimens can be hardened to a considerable degree, however, by cutting them in flat pieces, about $\frac{1}{2}$ an inch thick and placing in alcohol. Pieces of the trachea should be preserved along with the lung. (3.) The liver and gall bladder. Cut out one inch cubes from the liver, which should include the capsule on one side. With scissors, slit up the gall bladder and preserve in alcohol. (4.) The kidneys, specimens of which can be placed with the liver. (5.) The mesentery. Separate the intestines, and the web-like mesentery which binds them together will come into view. Search for the pacinian corpuscles, which are to be found as white specks in the

substance of the membrane. Cut out a piece, including corpuscles, make it tense on a stretcher, fix with pins at the four corners and drop into Müller's fluid. (6.) The œsophagus, stomach, intestines, ileo-cæcal valve and colon. Slit them open, cleanse *gently* and place one inch pieces of each in alcohol. If desired, a short piece of intestine can be washed out with water and preserved without opening. (7.) The pancreas, and (8.) the spleen. Preserve cubes in alcohol. (9.) The testicles and penis. Remove the testicles from scrotal sac, dissect out penis and put in alcohol. (10.) The tongue and larynx. Remove the head by cutting down on the vertebral column from *behind*. Disarticulate the jaw and the tongue and larynx can be removed *en masse*. Divide the tongue in halves by a longitudinal median incision and preserve in alcohol. The larynx should be put in Müller's fluid. (11.) Submaxillary gland. Remove and preserve in alcohol. (12.) The brain. Remove the skin, then, with a pair of nippers or forceps, snip away the bone, beginning at the ridge of the nose. Care should be taken not to injure the brain or eyes during the operation. With patience the brain will be finally uncovered. With scalpel and scissors separate the attachments and nerve connections; lift out carefully, wash and divide by longitudinal incision. Place in Müller's fluid. (13.) The eye. A little more careful snipping will expose one. Preserve, without opening, in Müller's fluid. (14.) Nerve. At the base of the spine large nerve-roots will be found. Cut out one or two of the large ones, place on stretcher and immerse in Müller's fluid. (15.) Muscle. Take a piece from the thigh. An outer piece attached to the fascia can be made tense on a stretcher and dropped into Müller's fluid. Another portion, unstretched, can be placed along with it. (16.) Bone. Remove the thigh bone, clean, cut in two and preserve in Müller's fluid.

Samples of the most important tissues have now been obtained. Those preserved in alcohol will probably need no further care: it might be well, however, to look them over occasionally. If, on shaking the bottle, little fluffy pieces fill the liquid, or if a cloudy sediment collect in the bottom, the alcohol should be changed and a few of the specimens removed to another jar. The proportion of hardening fluid to tissue should be about as 10 to 1. If this proportion is maintained, trouble will very seldom arise.

After four or five days the jars containing Müller's fluid should be emptied and fresh fluid added; a week later, remove to alcohol all the specimens hitherto in Müller's fluid, excepting, however, the brain, eye and bone. The work is now over and the specimens will harden nicely without further care.

EDITORIAL.

THE MICROSCOPE IN THE LEGAL PROFESSION.

THE importance and usefulness of this great instrument grows with every year. Its valuable service is by no means restricted to the medical profession, whose especial favorite it is. It has interested itself in the varied fields of manufacture, especially in pharmacy and chemistry, where it has become as indispensable an article of furniture as the "mortar and pestle" to the apothecary; but its orbit has widened and continues to widen with almost every new moon. It is, perhaps, not generally known how very useful it has of late years become in the legal profession. A few years ago, when a question arose as to the authenticity of signatures, or suspected alterations in a written instrument (such as deeds, wills or promissory notes), the only means the court and jury had to settle the vexed question was to call in men reputed to be "experts" in the matter of handwriting, such as bookkeepers, paying tellers in banks, scriveners and copyists, and take their opinions for what they were worth. Oftentimes very shrewd judgments were given by such witnesses; but the best opinion in a delicate case was generally submitted as a mere guess or conjecture, with such reasons as the observer had to offer in its support—and smart lawyers generally managed to introduce as many expert witnesses on one side as were offered on the other, and so the jury instead of being helped, were only the more perplexed over the question which they were sworn truly and correctly to decide. The rule of law being that any *material* alteration in an instrument rendered the entire document void, it will be seen how large interests of contending parties were often suspended on the correctness of the human eye—unaided, it was as difficult a task in many cases as for the observer to tell by a glance the number of fibres in a leaf, or threads in a fabric offered for inspection. In cases of forgery, the freedom or imprisonment of the suspected party was made to turn on the stumbling judgment of unlettered and unskilled men in the jury box. But to-day, in all such cases the microscope is summoned into court, and its silent testimony solves the riddle in almost every case. There is no impeaching this expert witness. Call as many microscopes to the witness stand as may be desired, they all tell the same story—no conflict between them, and the case is settled beyond the possibility of a doubt. In the matter of counterfeited currency the microscope has become a *vade mecum* to every modern bank clerk charged with the responsibilities of a receiving teller. If a glance of his well-trained eye awakens a suspicion as to the genuineness of

a Government note, he has but to place it under his microscope and his doubt is made a certainty. His testimony, therefore, in behalf of the Government against the counterfeiting engraver fixes his destiny at once. The relations which the microscope sustains to medical jurisprudence are none the less important, indeed, they are still more valuable because there they bear upon human life instead of human liberty merely. The criminal whose garments are stained with human blood can no longer relieve himself of a suspicion by saying they were discolored by the blood of a slaughtered sheep or calf. The microscope looks down upon them, searches out the corpuscles and renders its verdict at once as to whether the prisoner wears the badge of murder or whether he should go free. Also in all the variety of criminal cases in which poison is suspected and where felonious miscarriage is charged, the microscope is now a swift and essential witness in ascertaining and settling the exact facts—indeed, it has become as indispensable to the legal profession as to the medical, as might be yet more conclusively here demonstrated had we space in which to expand this article. We leave the subject with the remark, that in the whole realm of science there is no instrument yet discovered that, in practical usefulness, can compare with the microscope, and therefore it is we are inspired to promote and expand its sphere of science in the cultured and civilized world.

PROF. STOWELL'S latest work, a review of which will be found in another column, is undoubtedly the finest monograph on the histology of the teeth in the English language. Every microscopist will find it an important addition to the library. It may be obtained of the publishers of *THE MICROSCOPE*.

WE are glad to note that microscopy in all departments is flourishing in the far west. Our monthly reports from San Francisco show an energy, manifested by the society in that city, which might put to blush more than one of the eastern fraternities. The society in Kansas City, Mo., although organized but a few months ago, is in a most prosperous condition, and doing excellent work. The Denver Microscopical Society's programme for this season embraces some six interesting and valuable papers, besides the exhibits of specimens and apparatus. From San Antonio, Texas, we hear of valuable work being done in the line of medical microscopy. We hope that the reports of these societies, published in *THE MICROSCOPE* from month to month, may serve as a stimulus to others, and that in both eastern and western states the present year may record great advancement in the development of methods, as well as in actual discoveries.

WE notice that Dr. F. L. James, of St. Louis, is soon to publish his excellent articles on microscopical technology in book form. These papers, extracts from which have frequently appeared in THE MICROSCOPE, were contributed during a period of more than a year to the St. Louis Medical and Surgical Journal, of which Dr. James is editor, and have found a host of readers, who will now be glad to possess them in more convenient, compact and permanent shape. A review of this work will soon be published in our columns.

ACKNOWLEDGMENTS.—We have received from Prof. A. Y. Moore, Cleveland, Ohio, one of his finely stained and mounted slides of urinary casts; from Prof. George R. Koenig, Philadelphia, Pa., diatomaceous earth (Gray's Ferry Road); from Mr. K. M. Cunningham, Mobile, Ala., some cleaned Pensacola Bay diatoms, the beauty of which is beyond description; from R. Munger, M. D., San Antonio, Texas, some photo-micrographic negatives of chicken lice, urinary sediment, foreign bodies in mucus from nose, etc. These negatives were taken with a landscape camera, by lamp light, and the doctor is to be congratulated on the excellence of the results, which indicate long experience in microscopical methods; from Dr. F. P. Peck, of the Iowa Hospital for the Insane, comes a fine photo-micrograph of Koch's comma bacillus; from Mr. Arthur J. Doherty, of the College Microscopical Depot, Manchester, England, a box of sample slides. We can truthfully say that we have never seen better examples of staining and mounting than as here presented. Microscopists who wish to fill empty spaces in their cabinet, will do well to consult Mr. Doherty's catalogue.

TECHNOLOGY.

AN IMPROVED METHOD OF PREPARING AND STAINING THE BACILLUS TUBERCULOSIS.

Henry L. Tohnan in the *Medical Record*, October 23, gives a modification of the Weigert-Ehrlich method of staining the tubercle-bacillus which we have found to be very satisfactory. He uses the following formulæ:

1. Aniline oil M. xxx; distilled water, $\bar{3}$ iij. Shake vigorously for five minutes and filter.

2. Saturated solution of fuchsine in 93 per cent. alcohol. Prepare the sputum in the usual manner by spreading thinly on a cover glass and drying. Pass the glass to and fro in the flame of an alcohol lamp for fifteen seconds. For staining take of No. 1, $\bar{3}$ ij, and of No. 2, M. xv, and mix. Drop the cover glasses on the liquid con-

tained in a watch glass, (an individual butter dish is cheap and convenient,) and allow it to remain at least twelve hours. After staining wash the cover glass in pure water and decolorize in a 33 per cent. solution of nitric acid until the sputum appears nearly colorless. A second washing in water follows, and if the red reappears, but rather pale, the process has been carried far enough. If, however, the specimen is entirely colorless after the second washing, it is an indication that it has been too long in the nitric acid, and on examination, the bacilli will be found only faintly visible, if at all. Just here the greater number of failures occur, and only practice can determine how far to carry the decolorizing. It is, however, far better to decolorize too little than too much.

When time is important, heat the fluid to 50°C., and allow the cover glasses to remain in an hour. They can be still more rapidly stained by making the staining fluid a little stronger and the preparations heated to about 60°C. Fair results can be had in twenty to thirty minutes. In all cases of quick staining the nitric acid solution should be much weaker, from 5 per cent. to 15 per cent. A double stain is not necessary, but if one is desired, float the cover glass on a saturated aqueous solution of methyl blue for from three to five minutes and then wash. For mounting, use glycerine, as it can be washed off if it is desired to permanently mount the specimens in balsam. The author also recommends a convenient method of preserving and at the same time staining sputum. The solution can be given to the patient and the sputum first coughed up in the morning may be preserved. Formulæ of solution :

Aniline oil solution, as above, 3 ij; fuchsin stain, M. xx; carbolic acid, ten per cent. solution, M. v.

This solution should be prepared fresh. The sputum should be left in the stain twenty-four hours and if not then sufficiently stained resort may be had to the ordinary method. The specimen is to be decolorized and mounted in the usual manner.

KARYOKINESIS.—In the study of karyokinesis in the arthropods, Professor J. B. Carnoy obtained the best results with the two following mixtures: (1). Chromic acid (2 p. c. or more), 45 parts; Osmic acid (2 p. c.) 16 parts; Glacial acetic acid, 3 parts. (2). Corrosive sublimate. Glacial acetic acid (1 p. c.). The object (testes) is left from six to ten minutes in one of these mixtures; then washed in distilled water and further hardened in alcohol.—*American Naturalist*.

ANILIN BLUE-BLACK.—Dr. G. Jelgersma in defending anilin blue-black from the attacks recently made upon it, recommends the English made dye, from which he has always obtained most satisfactory results.

1. The preparations are permanent; specimens exposed to full daylight for over a year have not deteriorated.

2. Anilin blue-black is specially adapted for nervous tissue, axis-cylinders, ganglion-cells and their processes. In preparations of the cortex cerebri et cerebelli, Purkinje's cells, with their processes are seen branching as far as the periphery. Pathological changes in the ganglion-cells are most easily observed in this stain. The axis-cylinders become dark-blue and easiest recognized in vertical section, although in oblique and parallel directions they are very clear. Ganglion-cells become bright-blue; the nuclei and nucleoli dark-blue, the processes as well as the cell-body being stained.

3. Anilin blue-black is of no value for connective tissue and the neuroglia; for these the author uses alum-cochineal hæmatoxylin, or the Böttcher-Hermann anilin-dye method.

The staining is very simple. The author uses three watery solutions, 1 in 100, 1 in 800, 1 in 2,000, which stain in four, five, and twelve hours respectively. Then alcohol, oil, and balsam.

5. Anilin blue-black tires the eyes much less than carmine, an advantage not to be undervalued when a large number of serial sections are to be compared.—*Journal R. M. Society.*

COLLECTING URINARY SEDIMENT FOR MICROSCOPICAL EXAMINATION.—Dr. Charles W. Dulles, in *Medical News*: I am strongly impressed with the advantage of allowing the sedimentation of a specimen to take place in a straight glass, and not in a conical one, as is recommended in most of the books. In the latter, I think, one may easily miss a few tube casts, because they are not heavy enough to resist the attraction and friction of the sides of a conical glass, and so never find their way to the bottom. For this purpose a test tube with a foot is the best receptacle. After leaving the urine to settle in such a test tube for twenty-four hours under a paper cover pressed down and around the top of the tube, I take a long, pointed glass tube, close the upper end firmly with my finger, and, pushing the point through the center of the paper cover of the test tube, thrust it steadily to the bottom of the urine. I now remove my finger, and the bottom layer of the urine, containing the deposit of twenty-four hours, flows up into the long tube. When it has risen to the level of the urine in the test tube, I carefully twist a piece of soft paper over the upper end of the second tube, or stuff a small

bit of absorbent cotton into it, to keep out all foreign substances, and allow the apparatus to stand undisturbed for twenty-four hours or longer, during which the deposit contained in the column of sediment falls to the bottom of the smaller tube. At the end of this time I close the upper end of the smaller tube firmly with a finger, withdraw it carefully from the test tube, and then allow the two or three drops nearest its point to run out on a slide, in two or three places, cover them properly with thin glass, and put them under the microscope.

PERENYI'S FLUID.—M. de Castellarnau gives the formula of Perenyi's Fluid: Nitric acid, 4 vols.; chromic acid, 3 vols.; alcohol, 3 vols. This has been found excellent in preparing eggs and embryos, especially of the salmonidæ. The eggs should remain four or five hours in the fluid, and are then passed through several alcohols up to 70 p. c., or, if to be preserved, alcohol absolute. Dr. Perenyi advises staining at the time the eggs are in the alcohol, by adding an aniline dye to the spirits. Borax-carminé may also be used.—*Journal de Micrographie*.

ABSTRACTS.

THE MICROBE OF MALARIA.

Through the careful observations of the blood of over fifty cases of malarial fever by Dr. Osler, the peculiar bodies as found and described by Laveran, Marchiafava, Celli, Golgi, Sternberg and Councilman, seem to settle the fact that we have found at last a microbe peculiar to malaria. He described the bodies as occurring inside the red corpuscles and free in the plasma. The intra-cellular form appears as either a hyaline or a darkly pigmented body, filling one-third or one-half of the corpuscle and has slow but distinct amœboid movements. The hæmoglobin of the corpuscle is gradually destroyed by the organism and the stroma grows pale and finally colorless. The amœboid movements are readily demonstrated with a high-power objective.

The forms occurring outside the corpuscle are still more remarkable. These are (1) small, circular, pigmented bodies; (2) curious, crescent-shaped organisms; and (3) an extraordinary flaggellate body resembling an infusorium. The pigmented crescents are much easier demonstrated than the amœboid bodies. They appear only in the later stages of the disease.

A flagellate form pigmented was seen in but six cases. The movement of the flagellum is very active so that it brushes away the red corpuscles within its reach.

These organisms are considered to be parasitic and belong to the flagellate infusoria. It is found not only during the fever but in the intervals (*Amer. Practitioner and News*). Its presence may be detected in severe cases, where peculiar cachexias may suggest malignant growths and the differential diagnosis completed and the proper treatment instituted which may be for the saving of the patient.

MALIGNANT BACTERIAL ENDOCARDITIS.—Bacteria are frequent in a certain proportion of cases of acute ulcerative endocarditis in the cardiac, and, when these exist, in the peripheral lesions. These bacteria are small and of spheroidal form in almost all of the cases thus far described; but in a few cases the presence of bacilli has been noted. These are cases of ulcerative endocarditis with extensive destruction of tissue and large formation of thrombi, in which the lesions are entirely free from bacteria. In these cases, as a rule, the endocardium is the seat of an old inflammatory process, and the peripheral embolisms, infarctions, etc., do not contain bacteria. The destructive process and formation of thrombi in the heart-valve and endocardium may be as marked and extensive in the cases in which the bacteria are absent as in those in which they are present; but in the latter class of cases the embolic lesions, which are apt to be developed, are of an infectious nature, and the general course of the disease is apt to bear the stamp of an acute, infectious disorder. The two classes of cases may be appropriately designated as *ulcerative* or *acute ulcerative endocarditis*, but those in which the bacteria are present should be distinguished by the term *malignant bacterial* or *mycotic ulcerative endocarditis*.—*Dr. T. Mitchell Prudden, in Am. Jour. Med. Science.*

MOVEMENT OF WATER IN WOOD.—Herr M. Scheit propounds the theory that, in addition to the ordinary movement of water in wood, there is also a movement of water in the gaseous form—a movement of distillation. The former he regards as being occasioned exclusively by root-pressure. The distillation movement begins as soon as the cavities of the cells and vessels are no longer completely filled with water, and it can only take place when the temperature of the plant decreases upwards, which may result from the low conducting powers of the wood and soil connected with the loss of heat occasioned by transpiration. The vessels are the chief channels of the distillation movement, while the tracheids serve especially for the condensation

BLOOD OF INVERTEBRATES.—Dr. Howell, in John Hopkins' "Studies," describes the blood of the King crab, soft shell crab, and a species of holothurian. In *Limulus* the blood is alkaline, quickly coagulating. It contains fine albumens, which coagulate at different temperatures, but which all belong to the globulin group. They resemble, but are not identical with paraglobulin. Coagulation in the blood of *Limulus* results by the union of the corpuscles, and the existence of a coagulative ferment has not yet been proved. The fibrin is much like that of mammals in its solubility. Hæmocyanin certainly contains copper. In *Neptunus* (*Callinectes*), the blood is alkaline, but coagulates less quickly than that of *Limulus*. It contains two albumens to be classed among the globulins, and the coagulation is more complete than in the King crab. The fibrin is very different from that of *Limulus*, and of it Dr. Howell says: "The difference seems to me to be too wide to suppose any close relationship between the two forms, especially as they have the same general environments; but until a series of similar observations are made on the scorpion or some arachnid, we will not have sufficient evidence to make any just inferences with regard to the relationship of these forms—that is, from the standpoint here assumed." In the holothurian, which was identified as *Thyonella gemmata*, two kinds of corpuscles were recognized: a red, hæmoglobin-bearing nucleated oval form, and a spherical white nucleated form. Coagulation was occasioned by the fusion of the white corpuscles, the red not taking part in the formation of a coagulum except as they were entangled in the meshes of the other.—*Am. Naturalist*.

BACTERIA IN DRINKING-WATER.—Chas. E. Pellen, M. D., read before the N. Y. Microscopical Society, March 16, 1886, an article entitled "Bacteria in Drinking-Water." The writer calls attention to the necessity of having good drinking-water, and cites many instances where the water supply for ancient cities was obtained many miles away. Then follows an account of the first observations with the microscope and the discovery of the minute organisms now known as bacteria. A short history of the bacterium is next carefully given, with its power of development, its food, life, habits, times of quiescence and final death. Then follows a brief synopsis of cultivation of the bacteria, as recommended by many investigators; after which the bacteria in drinking-water are referred to and are considered harmless to mankind, except as it may contain germs of typhoid fever and cholera.

ORIGIN OF SARCOMATA.—Dr. Jos. Schöbl, of Prague, has a very valuable paper in the September number of *Archiv Für Mic. Anat.*, entitled "A Sarcoma Composed of Epithelial-like Cells of Lymphoid-Cell Origin." The tumor in question was found to be composed of cells not to be differentiated from epithelium, and mixed in with these in all portions of the tumor were large numbers of lymphoid cells. Between the two were found all possible gradations in form. It might be made an objection that the lymphoid cells were present as the result of inflammatory action; but this is disproven by the fact that, in the hundreds of sections made, the most striking intermediate cell-forms were found in all. Again, the tumor, after its first removal, recurred with such rapidity as to fill the orbit in a couple of weeks (it grew originally from the lower lid). None of these epithelial-like cells were found in stages of subdivision, though many possessed double nuclei, and a few had taken on the character of giant cells. Considering the rapid growth, it seems, therefore, impossible that these cells could have arisen from others of like character. Whence did they come then? For an answer, Schöbl refers to the transitional forms found between them and the lymphoid cells. The question now arises: If lymphoid cells can give rise to the epithelial-like cells found in the sarcomata, why should they not create cancer cells as well? And, finally, what is the meaning of the large numbers of lymphoid cells found in the growing portions of cancer, *i. e.*, the so-called indifferent tissue of the periphery?

NERVE-ENDINGS IN THE CUTANEOUS EPITHELIUM OF THE TADPOLE.—Mr. A. B. Macallum, in his second essay on this subject, states that there are two plexuses of non-medullated fibres, one wide-meshed, set some distance below the corium, and the other very narrow-meshed immediately below the epithelium. The first may be called the primary or fundamental plexus, and it sends up fibres which unite with the secondary or sub-epithelial plexus. From the former fibres also pass up and terminate in swollen bead-like bodies between the epithelial cells. From the latter minute fibres arise, which either terminate within the epithelial cells, near their nuclei, or between them. The fibres, which enter cells of the basal and intermediate layers of the epithelium are provided with the figures of Elberth; these decrease in size as the cells containing them show fewer and fewer signs of vitality. The figures appear, therefore, to protect the intracellular ends of the nerve fibres from the vital processes of the cells. These figures are the production of the intracellular end of the nerve fibres, and are formed by, or from the cell protoplasm.

Free intercellular nerve endings are due to the intercellular fibres losing their cells with which they are connected, and such are, consequently, most common between the superficial cells.—*Journal R. M. Society.*

MOVEMENTS OF DIATOMS.—Mr. W. H. Shrubsole in *The English Mechanic* says: "Although I have studied the living forms for years, I am quite unable to account for the marvelous phenomenon. By Prof. W. Smith it is referred to forces operating within each frustule and originating in the vital operations of growth, which may cause the surrounding fluid to be drawn through one set of apertures and expelled through another. The existence of apertures is clearly established, and is exemplified in the mineralized forms I had the good fortune to find in the London clay; but granting this, if the motion be the result of aqueous currents, how is it that one does not see this outside the diatom? If anyone with better apparatus than mine has seen small particles influenced by the supposed endosmosis and exosmosis, I would be glad to receive information. Some diatom motion that I have observed has been clearly attributable to the superior attractive force of an associated group lying near, and I have sometimes thought that the molecular movements first observed by Sir Robert Brown in 1827 should be taken into account. Still, as far as I know, the problem as to the active power has yet to be solved. The movements certainly are wonderful, and when watching the more active forms, it is hard to dispossess oneself of the idea that they are sentient organisms. Especially is this the case with *Bacillaria paradoxa*, which, being well-known, need not be described. In conclusion, I would point out that the power of motion seems to be largely dependent upon form. The discoidal and triangular diatoms are generally, if not always, immobile; those that are boat-shaped move freely, and most active are those of linea outline. I may briefly add that I have quite recently met with some of these last-mentioned in London clay, all that I had previously found in that formation having been either discoidal or triangular.

CHLAMYDOMYXA IN THE ENGADINE.—Dr. E. Ray Lankester, writing to *Nature*, says that since Mr. Archer, of Dublin, published his account of the protozoon to which he gave the name *Chlamydomyxa*, in the *Quarterly Journal of Microscopical Science* twelve years ago, no one has been in a position to independently confirm his description. While at Pontresina last August, Dr. Lankester discovered a protozoon which he thinks belongs to Archer's genus

Chlamydomyxa, and which he says is extremely abundant in the Swiss locality. He thus describes his observations of the specimens secured, under the microscope: "But I found a number of yellowish spheres, about $\frac{1}{150}$ inch and less in diameter, which excited my suspicions. After a brief delay these began to throw out protoplasmic filaments, and soon, around each, was a wonderful series of branching stems of protoplasmic threads, reaching far away from the central yellow granular body, and in the most varied directions. Along the threads minute oval corpuscles slowly streamed. * * * From what I have seen of Chlamydomyxa, I am now inclined to admit that it is *less* closely related to Cienkowski's Labyrinthula than is generally supposed. The moving corpuscles of Cienkowski's organism are very much larger bodies than are the oval corpuscles of Chlamydomyxa."

MICROSCOPIC APPEARANCE OF GLASS AFTER PASSING OF INDUCTION DISCHARGE.—Two years ago, when making some experiments with a large induction coil, I found that when a thin microscopical cover glass was placed between the secondary electrodes it was very quickly pierced by the calorific discharge. On looking at the glass a small roughened spot was seen around the point where the discharge had passed. When this is examined with the microscope (50 diameters and polariscopic attachment), small blue crosses are seen over the field, and generally a few of larger size are to be made out. Is there any theory in regard to the formation of the above, or are they simply caused by air bubbles carried through the heated glass by the force of the discharge?—A. B. Northcote in *Egl. Mechanic*.

THE MICROSCOPE IN MINERALOGY.—Prof. J. W. Judd writes as follows: The recognition of certain characters in the rock-forming minerals as being original and essential, and the distinction of such from other characters which are secondary and accidental, is of the highest importance to the petrographer and geologist, and not less so to the mineralogist. Rightly studied, these minerals are capable of furnishing the geologist with evidence not only concerning the mode of origin of the rocks of which they form a part, but also of the changes which they have undergone since their first formation. The study of the minerals included in the crystalline rocks is not less important than that of fossils in the sedimentary rocks. And to the mineralogist the study of this secondary characters of minerals, and of the causes which have produced them, is equally necessary. Researches of this kind, indeed, can scarcely fail in the end to

reduce many so-called mineral species to the rank of accidental, though still highly interesting, varieties. But of still greater importance is the recognition of the fact that the investigation by the aid of the microscope of the processes by which minerals have acquired their several characters, and the consequent tracing of the evolution of mineral species and varieties, is calculated to raise mineralogy from its present rank as a merely classificatory science; to infuse it with new life; to open out to it new realms of research, and to invest it with a higher importance than is at present accorded to it in the family of science.—*Journal R. M. Society.*

ORIENTING LARGE OBJECTS IN PARAFFINE.—In embedding smaller objects the orientation is facilitated by employing some such instrument as Zeiss' dissecting microscope, but for larger objects a simpler contrivance answers every purpose. The glass plate upon which the embedding is to be performed is placed on top of an ordinary glass dish, 5^{cm} deep and 10^{cm} in diameter is a convenient size, at the bottom of which a small mirror is so adjusted as to make an angle of a little less than 45° with the horizon. With the mirror turned toward the window, light traversing the sides of the dish is reflected upwards, and renders the outlines of the object sufficiently distinct for most purposes of orientation.—*American Naturalist.*

NEWS AND NOTES.

PROFESSOR WINDLE has announced to the British Association, as conclusions from his researches on the subject, that man's original dentition included six incisors in either jaw; that two from each jaw have gradually disappeared; that this loss is due to the contraction of the anterior part of the palate; that this process of contraction will probably go on and result in the loss of two further incisors; and that the conical shape of many of the supernumerary teeth indicates a reversion to the primitive type of tooth.—*Medical News.*

IN his paper on the Chromatology of Certain Actinas (Philos. Trans., vol. 176), MacMunn states of the "yellow cells," that the fact that they appear to cause a suppression of those pigments which, in other actineae, appear to discharge a respiratory function, is an argument in favor of their being regarded as symbiotic algae.

WOLF has found in the inter muscular connective tissue of the flesh of oxen a parasite which is apparently the form of an ascaris. It is encysted like trichinae, but is somewhat larger, and is nearly spherical in shape.—*Phila. News.*

APROPOS of the statement in the December number, that Zeiss had recently issued his 10,000th microscope, we learn that Beck & Co., London, have manufactured over 14,000, and, that of this number, over 5,000 have passed through their Philadelphia house in this country. A good record.

A SCIENTIFIC society of Haarlem, Holland, offers a gold medal and 400 florins (about £33) for the best treatise, which may be written in English, on the researches of M. Pasteur, to be sent in before April, 1887.—*Pop. Science News*.

THE death is announced of M. Jules Lichtenstein, the well-known investigator of the phylloxera.

THE committee on scientific facts of the U. S. Hay Fever Association, offers a prize of \$25 for the best essay on hay-fever sent to the chairman before April 30 of the present year. The Rev. Samuel Lockwood, Ph. D., treasurer of the N. J. Microscopical society, is the chairman, and may be addressed at N. Freehold, Monmouth Co., N. J.

MILNE EDWARDS has found five new species of telphusidæ in the Brazza collection from the French Congo.

T. B. STOWELL, PH. D., in a paper read before the American Philosophical Society, has given, in a most concise and thorough manner, the anatomy of the trigeminous nerve of the cat. Dr. Stowell has, in this contribution to comparative neurology, cleared up many points which have hitherto been obscure, and has thus been of great service to students of human physiology. His paper on the vagus nerve in the same animal, read before the same society some years ago, was equally valuable, and together they will have an important bearing on the future of neurological science.—*Science*.

BOOK REVIEWS.

HOW TO WORK WITH THE BAUSCH & LOMB OPTICAL CO.'S MICROTOME, AND A METHOD OF DEMONSTRATING THE TUBERCLE BACILLUS, by James E. Reeves, M. D. pp. 27. Rochester, N. Y.: Bausch & Lomb Optical Co. 1886. Price 50 cents.

In this little book Dr. Reeves presents a brief, yet complete system of rules for using the microtome. The methods which the doctor uses for preparing specimens for cutting, are imbedding in paraffin, mounting with acacias on cork, and the use of celloidine, to say nothing of the new Reeves commentater method, which is well worth attention and a trial by all workers who have heretofore used liver instead.

The immediate fixing of specimens to the slide, the centering of specimens and the use of the freezing microtome are clearly explained and show plainly that the doctor has fully tried all the plans before indorsing or making them public. Then follows a short chapter on the method of demonstrating the tubercle bacillus.

We have tried the method recommended, but find it somewhat unsatisfactory because of the difficulty of maintaining the temperature at 110° Fahr. However, the slides that the doctor makes with this method are among the best that we have seen.

THE THERAPEUTICAL DRINKING OF HOT WATER, ITS ORIGIN AND USE; ORIGIN OF THE SALISBURY PLANS OF DIET IN CHRONIC DISEASES, WITH DIRECTIONS FOR PREPARING BEEF PULP, by Ephraim Cutter, M. D., New York: W. A. Kellogg. 1886. pp. 34.

Dr. Cutter is well known to the readers of this journal as a clear, terse writer, thoroughly familiar with the subject with which he deals. The first of the papers in the little book before us has already met with an appreciative reception, as it has been republished some five or six times. The second paper on the Salisbury diet plan, although written as long ago as 1880, will be read with pleasure by practitioners and laymen, for it is full of interesting and valuable suggestions. We differ materially, however, from the statement of Dr. Salisbury in "Appendix B," that measles is produced by the vegetation of decaying wheat or rye straw, or that the inoculation of this fungus gives immunity from the real disease. This theory was, during the late war, held to be true, but subsequent experiments proved it fallacious.

ANNUAL REPORT OF THE CURATOR OF THE MUSEUM OF COMPARATIVE ZOOLOGY, AT HARVARD COLLEGE, 1885-86.

We are glad to note, in this report, the increased interest that is being taken by students and the public in the subject of Zoology. The Agassiz Museum is already too small to accommodate the students who apply for instruction on special work.

THE MICROSCOPIC STRUCTURE OF A HUMAN TOOTH, TOGETHER WITH SOME UNUSUAL AND IRREGULAR FORMS OF TEETH, by C. H. Stowell, M. D., F. R. M. S., Professor of Histology and Microscopy in the University of Michigan, etc.; Chas. H. Stowell, publisher, Ann Arbor, Mich.; C. W. Arnold, Detroit, Mich., general agent for United States. Price \$6.00.

This work is issued in the form of an atlas and with the elegance of an *edition de luxe*. Its object, as given in the preface, is twofold. "First, to give to the dental profession plain and definite statements concerning the minute structure of the human teeth, and, second, to place on record some of the specimens from the unique collections of Professors Ford and Taft." To do this, careful and detailed drawings were made by the author, and then were engraved

in a manner to insure great accuracy. In order to preserve the beauty of the plates, a "working diagram" is introduced, through which special parts of any plate can be found at a glance. In this way the disfigurement caused by numerous indices is avoided. The full page plates are: a molar; a longitudinal section of an incisor, and another of an inferior molar; a transverse section of a bicuspid root; blood vessels of pulp; section of root parallel to dentinal canals; two dentinal canals; odontoblasts, enamel, etc. Each plate is accompanied by an explanatory text. Very interesting are the engraved examples from the valuable collections of Professors Ford and Taft. One seems to find here all possible anomalies and freaks of growth. Appended is found a full description of the teeth as understood to-day, together with directions for preparing sections. The work is encased in a leatherette portfolio, and makes a handsome appearance. It is a credit not only to the author, who has used his opportunities to the best advantage, but to the engraver and printer as well.

VICK'S MONTHLY MAGAZINE AND FLORAL GUIDE, ROCHESTER, N. Y.

NOVEL METHODS OF TREATING DISEASES OF THE MIDDLE EAR, by Seth S. Bishop, M. D. Reprint.

A. B. C., AN ALPHABETICAL REPRINT. By J. Eyra, A. A. Garner Reprint. pp. 4.

RHINOLOGY IN THE PAST AND FUTURE. By Carl H. Von Klein, A. M., M. D. Reprint, Journal American Medical Association, Dec. 18, 1886.

MICHIGAN STATE BOARD OF HEALTH DOCUMENTS.

MANAGEMENT OF THE SECUNDINES: STERILITY. By W. H. Mathews, M. D. Reprint.

REPORT ON DISEASES OF RECTUM. By Joseph H. Mathews, M. D. Reprint.

TRICHINA SPIRALIS AND TRICHINOSIS, INCLUDING AN EXAMINATION OF INDIANA HOGS. By Thomas B. Redding, A. M., Ph. D.

CORRESPONDENCE AND QUERIES.

H. S., MOUNT CARROLL.—Vegetable sections, which are not injured by the shrinkage, may be mounted in balsam. There are, however, few that will bear this treatment. Farrant's medium, composed of gum acacia, water and glycerine, similar to the medium you suggest, answers very well. The most satisfactory medium for general work that we have used is glycerine jelly. This sets quickly and preserves the specimen well.

Dr. N., PARKEVILLE, MICH.—A No. 5 objective or higher is necessary in examining for *B. tuberculosis*.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be given ONE INSERTION FREE OF CHARGE. Dealers are referred to our advertising department.

X. Y. will please forward his address to this office where a letter awaits him.

WANTED—Second-hand Microscope of modern American make, with accessories and objectives, 2 inch to $\frac{1}{4}$ inch focus. Parties having same, in whole or in part, please address
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TO EXCHANGE—Carpenters, "The Microscope and its Revelations," new, for Beal's "One hundred urinary deposits," and Dolly's "Technology of Bacteria Investigation."
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100 POUNDS Gulf Marine diatom muds for exchange; 10 selections of cleaned Marine Gulf diatoms. Correspondence invited from anyone.
K. M. CUNNINGHAM, Land Office, M. & O. R. R. Co.

FOR SALE—A Beck Universal Microscope, with three eye pieces and two objectives, in mahogany case; price twenty dollars. Also a variety of slides for exchange.
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FOR SALE—At about one-half cost, a Tolles 1-6 water im. 180°, in perfect condition; or would exchange for a good working stand of recent make, Acme No. 4, Bullock's New Student, or Bausch & Lomb's Physician's, or Investigator. Address X. Y., care of the publishers of this paper.

FOR SALE—A new Zentmayer army microscope stand, binocular—made to order, with complete outfit of accessories. Box 119, Englewood, N. J.

INTERESTING MOUNTS in exchange for meat containing trichina.
H. M. WHEPLEY, St. Louis, Mo.

WANTED—A copy of Phin's "American Journal of Microscopy," No. 1 of Vol. I, for which I will send two well mounted and interesting slides; also one copy each of Nos. 11 and 12 of Vol. VI, for which one slide each is offered. M. S. WIARD, New Britain, Ct.

ECHEIN GREEN—New Stain, to stain from 500 to 1,000 sections, 15 cents; Chrokallos, pink, crimson, orange, and blue, 15 cents each; all sent by mail with directions for use. Pollen for sale or exchange.
J. D. BECK, Box 10, Liberty, Tioga Co., Pa.

HISTOLOGICAL and Pathological Mounts for exchange. Send lists.
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FOR EXCHANGE—Histological Mounts.
T. W. JOHNSON, M. D., Danville, Indiana.

FOR EXCHANGE—Mounted Histological and Pathological Sections.
W. C. BORDEN, M. D., U. S. A., Fort Douglas, Utah.

FOR EXCHANGE OR SALE—Mounts of Lepidoptera "Scales," Pollens, Starches, Animal Hairs, and a few Zoophytes.
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Address GEORGE H. McCAUSEY, Janesville, Wis.

I WILL EXCHANGE Arachnoidiscus on algæ and diatomaceous earth from different localities in the State; also slides of same for well mounted objects. Diatoms preferred.
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DR. F. P. PECK, of the Iowa Hospital for the Insane at Mt. Pleasant, offers fifty cents for No. 4, Vol. VI., of The Microscope.

FIRST-CLASS DIATOM SLIDES—250 species and deposits, including tests. Also miscellaneous objects, mounted and unmounted, at the lowest possible cash rates. Correspondence invited.
M. A. BOOTH, Longmeadow, Mass.

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PUBLISHED ON THE 10TH OF EACH MONTH,

At 21 State Street, Detroit, Mich.

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Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. Box 583, Detroit, Mich.

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VOL. VII.

DETROIT, APRIL, 1887.

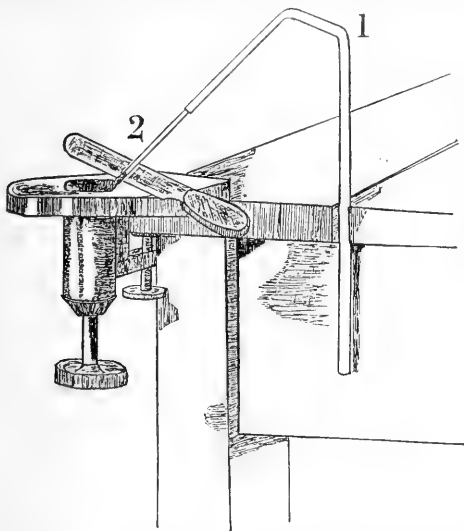
No. 4

ORIGINAL COMMUNICATIONS.

AN EXTEMPORIZED SECTION FLATTENER.

W. C. BORDEN, M. D., U. S. ARMY.

FOR the benefit of those workers in microscopy who, like myself, have been troubled by the curling of sections in cuttings made from interstitial imbedding in paraffine, I illustrate the simple device which with me has worked most satisfactorily.



It consists of a glass tube, 1 (see illustration) and a camel's hair brush, 2. The tube is bent over an alcohol lamp to about an angle of 45° . A hole is then bored through the table holding the section cutter, on the side farthest from the operator, and of such size as to hold the tube firmly, one end of which is passed down through it. Into the other end of the tube the handle of a camel's hair brush is thrust, whittling

it down to proper size if the bore of tube be too small. The tube is then raised or lowered through the hole in the table, the brush handle being at the same time moved further in or out of the tube until the brush lies lightly yet closely over the surface of the object

to be cut. A brush having long hairs should be selected, for if the hairs be short they are likely to be cut by the knife. For most sections a small round brush is to be used, but if the sections are large, a flat brush, wide enough to cover the sections, is to be preferred. Having adjusted the brush, the knife is passed between it and the rod, and the cut is made toward the operator, under the brush, when the section will be found lying perfectly flat upon the knife.

The thinnest and most delicate sections are not injured by this method. The tendency of sections to curl can also be obviated by using paraffines of different melting grades, using hard in higher and soft in lower temperature ; or by varying the thickness of the sections.

Both of these methods are, however, open to objection. It is extremely difficult to keep a room at a certain constant temperature, that temperature which corresponds to the grade of paraffine selected. Should the temperature of the room go down the sections will curl, while if it rises, as is very apt to happen in warm weather, the paraffine will become soft, and the sections will be hopelessly torn. Then, too, a paraffine suitable to the room temperature is not always best for the special object to be cut, and it has been my experience that the harder paraffines yield better results than the softer. They allow the cutting of thinner sections without tearing. As to varying the thickness of the sections, this is to be avoided, for in histological or pathological work, the thinner the section the better, and it is the thinnest and most desirable section which curls the most hopelessly.

For these reasons a harder paraffine, together with a section flattener, is to be preferred, and by the aid of the simple apparatus described the most delicate sections can be cut without either curling or tearing.

NO EXCESS OF BALSAM NECESSARY.

JAMES E. WHITNEY, F. R. M. S.

THE clearing away of a mass of hard balsam from around the edges of a cover glass, is a very disagreeable occupation to anyone, and is a task which, in the hands of a beginner, usually results in a ruined slide, and a very much damaged temper. Personal observation shows that there are a good many experienced workers who leave their slides in a very unsightly condition, on account of the difficulty they find in removing the excess of balsam,

without at the same time breaking or moving the cover, glass or otherwise injuring the mount.

It seems to be worth while to emphasize a fact that is overlooked in the books, where the cleaning away of balsam is made to appear as an unavoidable accompaniment of mounting in that medium. The truth is that there should be *no surplus balsam* whatever, as it is an unnecessary evil, due to miscalculation on the part of the preparer.

From experience, I find it is not difficult to graduate the amount of balsam used so that it will fill the space required without exuding. The balsam should be placed in the center of the slide, and the cover should be placed over it, so that the balsam is in its center. A very slight heat will make the balsam flow, if not already liquid enough, so that it will extend to the edge of the cover all around, and thus exactly fill the space and no more. If an object is to be mounted that requires pressure by the cover to keep it flat till the balsam is hard, of course only a very small amount of balsam is needed. In fact it is a good rule in all cases to use a little less balsam than seems necessary, as by a little pressure on the cover the balsam can be squeezed out to the edge.

Of course, these remarks apply only to the use of balsam without a regular cell, and this method is quickest, and answers admirably in almost all cases, unless a very thick object is to be mounted. When a cell is used it is impossible to avoid a small excess of balsam, as it needs to exude slightly around the cover to drive out the air from the cell, but even in this case if carefully graduated to the cell the excess need not be noticeable, and it can be covered with a ring of cement without being cleaned away at all.

Many microscopes are packed away and no work is done with them, for the reason that the owner met with such discouraging obstacles in his attempts at balsam mounting. For this reason it seems desirable that such of the usual difficulties of mounting in that substance as are avoidable, should be pointed out and emphasized.

MORE ABOUT CELLOIDINE.

WILLIAM BUCKINGHAM CANFIELD, A. M., M. D.

Lecturer on Normal Histology in the University of Maryland, Baltimore.

NOTWITHSTANDING the frequent contributions on the subject of celloidine as an embedding agent, a few words here may not be out of place. Although celloidine can be used for every kind of embedding, certain sections are much better made in paraffin, and particularly sections of small organs (whether previously stained in

toto or not), such as a gland or ovary. Celloidine, however, is especially applicable to those specimens which are loose in texture and the relation of whose parts may become changed by manipulation. Since the introduction of this embedding mass the study of the eye has been greatly facilitated. I have succeeded in making some good sections of the whole eyeball as well as of the anterior equatorial half.

The eyes, as fresh as possible, should be hardened for several weeks in a weak Muller's solution* taking care to change the fluid frequently; or by putting the vessel in the warm chamber, the eyes may be sufficiently hardened in a week or ten days, if the fluid be changed daily. Then they should remain in running water for 24 hours and then hardened in alcohol by gradually increasing its strength. The diffusion apparatus of Schultze is of great use here in preventing the shrinking of the eye—a thing which only great care will prevent. The celloidine should be used according to the method described by Czermak †. A small incision is made tangentially in the sclera and also in the corneal edges and the eye is put into equal parts of absolute alcohol and sulphuric ether, after 24 hours in ether alone, and the next day in a thin watery solution of celloidine in ether. Great care is necessary here to prevent air bubbles from getting into the eye. To avoid this the eye should be delicately seized with a small pair of forceps and shaken in the thin solution with the two incisions upwards, so that the gravity of the liquid will force out the air.

After 24 hours the eye is put in thick celloidine and the vessel is left partially uncovered, until the celloidine is hard enough to be cut, and then the block containing the eye is cut out, softened a few minutes in absolute alcohol, dipped once more in the celloidine solution and put on a cork, taking care that the preparation is in the proper position. If many eyes are prepared in this manner at the same time, it is well to burn numbers with an old needle on the corks, noting the corresponding numbers in the working book, to avoid confusion. The preparations on the cork should remain exposed to the air until the celloidine is stiff and then allowed to float in 84 per cent. alcohol until ready to be cut. Thin sections of whole eyes may be made, or any desired part may be cut out with a sharp razor and prepared without fear of disturbing the relations.

The advantages of this method in studying the ciliary apparatus, are too apparent. The aniline colors must naturally be avoided,

*Bichromate of potash, 1 to 2 parts; sulphate of sodum, 1 part; water 100 parts.

†Archiv fr. Ophthalmologie B:nd xxx.

as they stain the celloidine. Haematoxylin stains the celloidine also, but if the section be allowed to stand for 24 hours in a weak solution of acetic acid in water ($\frac{1}{2}$ to 1 per cent.) the celloidine is entirely decolorized, while the section has a delicate color. Rosin may be used as a contrast color. As clearing fluids, cedar or origanum oil may be used, while oil of cloves should be avoided. In using cedar oil the section must be carefully dehydrated.

ON MAKING SECTIONS OF INJECTED LUNG.

ARTHUR J. DOHERTY.

MOST practical histologists will no doubt concur with the statement that to cut and mount a really good section of injected lung is by no means an easy task; for, owing to the excessive shrinkage which invariably accompanies the process of hardening the tissue in the ordinary way, the capillaries distributed over the walls of the air-cells present more the appearance of masses of carmine than a fine net-work of vessels, which in reality they are. In order to prevent this shrinkage, I have devised a method of procedure which yields very beautiful preparations, and for this reason an account of the process may be of interest to the readers of this journal.

The lung is injected *in situ* through the right ventricle with a stiff, but freely-flowing, carmine-gelatine mass (Dr. Carter's formula answers admirably), care being taken to throw the mass in slowly and with a uniform pressure, and not to over-distend the vessels either by injecting too rapidly or for too long a time, *i. e.*, throwing in too much color. When properly filled, the pulmonary arteries and veins are ligatured, the lungs are removed from the body, and are then distended with 90 per cent. alcohol injected into the air-cells through the trachea, which is afterwards to be closed with a clip or "bull-nose forceps." The lungs are then weighted with lead, and placed in a quantity of 90 per cent. alcohol. In twenty-four hours they are taken out, the clip is removed from the trachea, and as much alcohol as possible is drained from the organs. After this, they are to be re-distended with 90 per cent. alcohol, and placed in a fresh quantity of spirits of that grade, just as before. This process is to be repeated on the fifth and tenth days, and at the end of a month the lungs will be found to be well hardened without being in the slightest degree collapsed; cut from one of the lungs, preferably at the root and transversely across a bronchus, a piece, say half an inch square and quarter inch thick; transfer it to a glass beaker half filled with methylated chloroform, place the beaker

in a water bath, and heat the water to 100° F. Shake the vessel occasionally to facilitate the saturation of the tissue with the chloroform, and in half an hour add very gradually (*i. e.*, in small pieces, one after the other) about 50 per cent. of paraffine. Keep the lung in this mixture for one hour, and then transfer it to a bath of pure paraffine kept for two hours at 3° F. above its melting point. The tissue will then be thoroughly infiltrated with the paraffine, and beautiful sections can be made without trouble with a hand microtome and a sharp razor. The sections are passed through three consecutive changes of warm temperature, and, finally, are mounted in balsam and benzole.

THE PREPARATION OF INSECT SPIRACLES.

FR. DIENELT.

THE spiracles of insects furnish a wide field for the student, and a great many instructive and interesting mounts can be secured with little trouble from the perfect insect, pupa or lava. In most beetles the spiracles are found in the upper part of the abdomen. Turn the insect on its back and cut across the thorax close to the abdomen; turn again and insert a sharp knife into the opening made, and cut around the whole abdomen. As soon as there is room, insert a small stick of soft wood, sharpened to a flat point, by means of which the object can be held securely while cutting. All the cutting should be done on the lower side, so that a margin is left on the upper part, which can be trimmed easily, after the object has become softened in liquor potasse. Steeping the insect in this fluid for a couple of hours, will destroy all the viscera. Now, holding the part down with the pointed stick, which for this purpose is far superior to mounting needles, and with a camel-hair pencil, remove the viscera and transfer the object to rain water, renewing this two or three times to insure cleansing and to remove the last trace of potash. Keep on brushing till it is certain that the object is clean, and then trim the edges to suit before a final washing. If it is desired to mount the trachea *in situ*, greater care is necessary in treating, but they show very well through the skin. Or, after most of the viscera have been removed, the tracheæ can be torn by a sawing motion with the back of the knife from the spiracles and mounted separate. In mounting larvæ entire, they should be left in the liquor potasse for a longer time. I have sometimes left them in for a whole day without injury. In cleaning, it is necessary to keep them in the position in which they are to be mounted. Larvæ of the Lepidoptera show best when mounted on

the side. In preparing these, hold the larva under water with the pointed stick, and clear out the viscera with a brush through the anal opening by a rolling motion. After a start has been made the process takes but a short time. Larvæ will stand considerable pressure in cleaning, but gentle manipulation, of course, answers best, especially in those covered with hair. It is best to commence with the largest beetles or larvæ one can find. Larvæ too large to be mounted entire, ought to be opened along the back to give the liquor free access.

Twenty-seven grains of potassa fusa to one ounce of water, is the formula I use. It acts but slowly on the chitinous parts of insects, but very prompt on the viscera and one's fingers. It is best kept in a paper-covered bottle to exclude the light.

PROCEEDINGS OF SOCIETIES.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE fifteenth annual meeting of this Society was held at its rooms, No. 120 Sutter street, Wednesday evening, Feb. 9th, the President, Dr. Mouser, in the chair.

Mounted slides were presented by Mr. Howard and Mr. Breckenfeld, showing the general character of the diatomaceous deposits, samples of which had been received from the State Mining Bureau at the preceding meeting, with a request for a report. The slides showed diatoms of the following genera: *Asterolampra*, *Coscinodiscus*, *Actinocyclus*, *Navicula*, *Arachnoidiscus*, *Grammatophora* and *Triceratium*, together with some *Polycistina* and many sponge spiculæ. Although a marine deposit, and containing many forms of the celebrated original Santa Monica fragment, the new find did not equal the original in many respects, especially as regards the diversity of contained organisms. In the original, more than one hundred perfectly distinct species have been determined. Many interesting facts were related regarding this unique fragment, which did not weigh over two pounds, and was found on the beach near Santa Monica in March, 1876. Many attempts have been made to discover the deposit from which this "ocean waif" must have become detached, but its location still remains a mystery.

The retiring President, Dr. S. M. Mouser, read an address in which he referred to the increase in membership of the Society during the past year, and said, "From every quarter we hear of renewed interest in microscopical matters, and find our own Society

keeping pace with the times." He referred to the visits of many distinguished microscopists during the year. "In our earlier days," he said, "the microscope, in our hands, was more of a toy with which to pass a few pleasant hours, than an instrument of real value in all matters requiring minute examination in scientific investigation, but now it has become an absolute necessity in not only the hands of the professional men, but to those who pursue almost all branches of industry. Any attempt to enumerate the purposes to which it is now of every-day application would consume too much of your time, and only tell you what you already know. It is gratifying that you have early recognized its value, and not allowed yourselves to relapse into indifference or neglect, but have been constantly on the alert for new fields of labor in which its application will aid you."

Meetings were reported to have been well attended, very enjoyable and beneficial, and have contributed to the advancement of microscopy generally. More than the usual number of matters of importance came before the Society, and every member manifested deep interest in the proceedings.

"A number of valuable papers have been read and illustrated in a manner that would do credit to any society. So much has been done that it would hardly be possible to enter into detail, though I cannot refrain from mentioning a most exhaustive paper by one of our members, which graced the first pages of the *American Microscopical Journal* for December, 1886, and I have no doubt will afford great pleasure to all who are interested in the subject. In mentioning this I do not mean to disparage the splendid work done by many other members, a detailed account of which would be too long for the present occasion."

The annual exhibition was greatly enjoyed, and probably excelled in all of its appointments any previous effort of the society. The annual receptions are much appreciated by guests. Valuable donations were received during the year, notably among them the splendid collection of diatoms from Wm. Norris, who had with great pains been years in accumulating them.

The retiring President had no suggestion to make as to the future, "other than that you pursue the course you have already adopted, of patient and industrial labor, each member laying out for himself the work best suited to his taste or the facilities at his command. By this co-operation we bring into the common store an amount of knowledge that could not be acquired by any one working single-handed." In conclusion, he thanked the members of the Society for uniform courtesy and kindness.

The reports of the Secretary and Treasurer were read, showing a gratifying condition of affairs, financially, and in every other respect. On motion, a vote of thanks to the retiring officers was passed, and the President's report was ordered spread on the minutes.

The balloting of officers to serve during the ensuing year, resulted as follows: President, E. J. Wickson; Vice President, Dr. Henry Ferrer; Recording Secretary, A. H. Breckenfeld (re-elected); Corresponding Secretary, Dr. C. P. Bates; Treasurer, F. L. Howard.

February 23rd.—The retiring president, Dr. Mouser, presented his successor, E. J. Wickson, who thanked the Society, in brief but fitting terms, for the honor conferred on him.

Dr. Stallard, who had intended to attend and present a report of his investigations of the *bacilli* in dairy milk, was unavoidably absent.

Professor Ashburner exhibited a slide which had been mounted by J. Kinker, of Amsterdam, from a specimen of the diatomaceous earth found by Mrs. A. E. Bush, of San José, in 1880, among some tidal refuse in Santa Monica Bay. The specimen shown in the slide contained 213 arranged diatoms.

The original "Santa Monica" find has become notable in the history of microscopy as the largest ever discovered on this continent, and Professor Ashburner sent samples of it to many of the leading microscopists of the world. M. Bourgoyne, of Paris, the famous mounter of microscopical objects, so highly appreciated the liberal share sent to him that he forwarded to Professor Ashburner a beautifully mounted slide containing a specimen of the earth, in which were two hundred and fifteen arranged diatoms. Where the original deposit is to be found is so far unknown, the Santa Monica specimen being only a fragment. There are one hundred distinct species to be distinguished in the Santa Monica sample.

The value of the diatomaceous earth arises from its adaptability for use in the transportation and manufacture of nitro-glycerine and other explosives, of which it forms the absorbent. The diatomaceous earth known as *Kieselguhr*, which is universally employed for that purpose, is lighter and richer in diatomaceous forms than the Santa Monica sample. No earth has been found in California, so far, well adapted to this purpose.

Secretary Breckenfeld exhibited a slide by Doherty, of Manchester, containing a section of the intestine of a rabbit, which had been slit longitudinally and the blood-vessels well injected with carmine, showing the *villi* and the capillaries of each villus with great

minuteness and beauty. A remarkable feature in the preparation was the perfect success with which the fine network of capillary vessels was injected with the carmine.

The president said an interesting subject for microscopical investigation by the members would be the reason why popcorn pops, while other kinds do not. Chemists claim that it is on account of the greater quantity of oil contained in the popcorn becoming volatilized by the heat, and he would like to have the matter looked into from the microscopical point of view.

A specimen of the *Kieselguhr* was exhibited by Professor Ashburner, and found very rich in diatoms.

A. H. BRECKENFELD, *Secretary*.

ELEMENTARY DEPARTMENT.

SECOND LESSON.

"CLEANLINESS IS AKIN TO GODLINESS."

INSTRUMENTS and reagents required : 1. Two needle holders. 2. A few slides and cover-glasses. 3. One ounce of pure glycerin. 4. A 1 per cent. solution of sodium chloride. 5. Four ounces of distilled water. 6. One ounce of sulphuric ether. 7. One ounce of acetic acid.

1. Two pen-holders will serve as well as anything else for grasping the needles, which latter should be of medium size, with good point, and inserted, eye-end, to about $\frac{1}{4}$ of their length in the holders. It would be well to have several of these holders fitted with needles of assorted sizes. If a more elegant instrument is desired, a few like these



in the accompanying cut, kindly furnished us by Bausch and Lomb, of Rochester, N. Y., can be secured. They cost about 15 cents each. Not more than one of the curved needles is needed, indeed, they are not at all indispensable for fine work.

2. Slides should be 3x1 inch in size, ground-edged and of medium quality. The chance-crown variety, though containing occasional flaws, is quite good enough. Round cover-glasses, $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter and tolerably thick. The thinner ones are, of course, more desirable, but are so fragile that the beginner will do well to let them alone until more experienced in handling the thicker ones.

3. Chemically pure glycerin, to be kept in a glass-stoppered bottle. In fact *all* bottles used for holding reagents, stains, etc., and employed for microscopical purposes, should, if possible, be provided with glass-stoppers. Wherever cork is used, even though the bottle-contents have no corroding effect upon it, small pieces become detached and dirt *will* get into the bottles. However, for glycerin and a few reagents to be mentioned hereafter, dropping bottles with



glass bulb, as here figured, will prove extremely convenient. They cost about 25 cents apiece.

4, 5 and 6. The salt solution should be prepared with distilled water. A convenient receptacle for the distilled water is what is known to chemists as a wash bottle. One can be obtained at low cost from any druggist. As ether is very volatile, the bottle containing it should be carefully stoppered.

TEASING.—The art of teasing is a much neglected one. There is a beauty, a completeness, an apparently clear exposition of parts in a well-cut and stained section that lead many to adopt this manner of preparing all tissues for microscopical examination.

When, however, one desires to study individual cells or tissues, teasing will be required that they be isolated and thus placed at the best advantage for study. Again, many softer substances cannot be cut at all, nor can they be hardened sufficiently for the purpose. Here teasing will do much better service than the one often employed—squeezing and crushing the specimen between cover and slide—which not only often distorts the parts and cellular elements beyond all recognition, but render it very opaque. It is urged, therefore, that beginners, and, for that matter, many who are more advanced, cultivate not only the art of teasing, but of recognizing the various elements so isolated. Such a course will do much to give a better understanding of various structures, and will lead to a knowledge of minutiae which could never be learned from a study of sections however well prepared. It is a matter of surprise, then, that the method is so little employed, and this surprise is increased when one considers that the method is simplicity itself. It is this simplicity which leads us to choose its practice for the first working lesson.

From a piece of fresh nerve, or, if this is not easily obtainable, from the nerve preserved in Muller's fluid and alcohol, with scissors, snip, longitudinally, a thin strip about $\frac{1}{2}$ inch in length. Place a drop of the sodium-chloride solution in the center of a clean slide (see hints for method of cleaning slide and cover-glass). Now,

fixing the nerve-shred on the point of a needle, place it in the center of the drop, and with the other needle, gently strip off threads from it. As the fibers run longitudinally the teasing should take the same direction. Do not pick off transverse pieces, nor break, any further than possible, the delicate, longitudinal fibrils. After a number of these fibrils are obtained, see if it is not possible to still further tease them into more delicate ones. When this process is complete, separate and straighten out the fibrils, add a little water and lower a cover-glass over them.

This lowering of the cover-glass requires a little practice. Do not drop it down with a splash. Take it up with the diameter extending between the index finger and thumb of left hand (if right-handed), and place one edge on the slide just in contact with the edge of the fluid. With the right hand, palm downward, take a needle-holder and support the cover by passing the needle under the upper edge. Now gently lower the cover, but no faster than the liquid is enabled to fill up the successive angles formed by the two glasses. This will avoid the forming of air bubbles—*les betes noires* of fastidious microscopists. When bubbles appear they do so at the advancing edge of the liquid. In this case they can often be dispelled by raising and lowering the cover glass a little, with a slightly jerking motion. The cover down, take up with a blotter the superfluous fluid around its edge, and the specimen is ready for examination.

Using a one-fifth objective, observe the fibers—many of which will be distinctly separate—their whitish, varicose appearance. Here and there the dark contour of the neurillemma will be visible and occasionally a node of Ranvier.

(NOTE.—As these lessons are only for the teaching of technique, the reader will do well to consult works on histology where descriptions of tissues are desired.)

Now irrigate with sulphuric ether. This is done by placing a few drops of ether on one edge of the cover and a blotter at the opposite edge. As the water is drawn off by the latter the ether replaces it. As ether evaporates rapidly it should be applied very freely. When the process is complete examine again, and it will be seen that the axis cylinders are now visible in many places: the medullary substance, which before obscured them, being of a fatty nature is now dissolved by the reagent.

Tease out a thin, longitudinal strip of striated muscle in the manner described for nerve and in the same solution. Observe the distinct and regular transverse striations of the fibers—a unique

feature. Irrigate with dilute acetic acid: nuclei appear beneath the sarcolemma. Prepare a little strip of heart muscle. Observe the striations and the short, branchate appearance of the fibers. Take little pieces, the size of pin's head, from liver and spleen; tease in glycerin and examine.

(NOTE.—As glycerin renders a specimen more transparent, it is to be preferred to the salt solution when the object to be teased is very opaque. If the glycerin be found to be too ropy, so that it interferes with the teasing, distilled water can be added to sufficiently thin it.)

This constitutes the lesson. Do not stop with the tissues mentioned above, but tease small pieces of everything that can be subjected to the operation. Study the results carefully, and it will not be long before beauties will be recognized in a teased mount equal to any to be found in the most elaborate sections.

HINTS.—For cleaning new slides and cover-glasses, it will be sufficient to polish them with a piece of soft, old linen. If they still seem cloudy, dip them in alcohol and rub briskly. If they have been used with glycerine or salt solution they should be washed with soap and hot water before polishing.

It requires considerable dexterity to quickly cleanse cover-glasses without breaking them. With a linen rag take them always on the flat between fore-finger and thumb, and rub gently to and fro. About a dozen will be destroyed before comparative success is attained. To many who find the linen too clumsy for cleansing these fragile glasses, we can recommend the so-called Japanese filter paper, much used by dentists in their work. Prof. Gage, of Cornell, uses it for cleansing the lenses of objectives and oculars. (See MICROSCOPE for December.) It is very soft and bibulous, and so thin as to allow very delicate manipulation.

In all work remember that "Cleanliness is akin to godliness." In spite of one's best endeavor, however, some dirt will be found in all specimens. It will be necessary, therefore, that the microscopist should be familiar with its most common forms when seen under the microscope. A good method for studying dirt is to leave a slide exposed till covered with dust. On this place a drop of water or glycerine, and cover. Examine in water the fuzz from a blotting pad and little fibrils from different cloths.

The recognition of air bubbles is also important. With a needle agitate a drop of glycerin placed on a slide. Slap the cover on it and examine the bubbles of different sizes. Focus up, and the

bubble will have a bright center and black rim, and will thus be brought out most prominently. Study at different foci.

The intelligent reader will study other forms of dirt than those mentioned here, and will find it not only interesting but very profitable.

EDITORIAL.

STAINS.

To the development of this branch of microscopical science we owe much; with its future perfection—if it ever obtain—will come the almost perfection of the science. In particular, this may seem an exaggeration; in general, however, we believe it true, and if true, the subject is not allotted the importance it deserves.

How often, for instance, we read of a new objective that promises wonders. Such and kindred productions, of great value withal, are examined and discussed, till the next new objective or what-not displaces it. All this is as it should be. But do we show the same enthusiasm and interest over a new stain that allows us, perhaps, to study some object more satisfactorily with a $\frac{1}{6}$ than could formerly have been done with a $\frac{1}{8}$? We think not. All this is wrong. Is the new apochromatic glass—granting, even, all that is claimed for it—of greater importance to us than the results of the studies in the anilin dyes that individualized the *B. tuberculosis*?

There are many who hold that we have about reached the limit of perfection in lenses. Be this as it may, the goal certainly does not seem to be so very far distant. But the province of stains has not as yet been invaded to any very great extent. And especially is this true as regards differential staining. To be sure we have double stains and treble stains almost *ad infinitum*, but they are very far from what they should be. That they can be improved, and perhaps perfected, we have really no reason to doubt. Bacteriological investigations, so active at the present day, are doing much to stimulate work in this important field. Along with the discovery of new stains should go the study of the effects they may have on the tissues—what changes they cause and in what manner these are brought about, that they may, if possible, be avoided. In short, *systematic work* is needed. It seems that in the results of such work we have the most potent means to thoroughly utilize the lenses we now possess, and through which only will many future discoveries be possible—be the lenses what they can.

ONE of the most characteristic programmes that has reached our table is entitled "An Evening in Wonderland," which was enjoyed at the First Baptist Church in Fairport, N. Y., Feb. 25th. Way down near the bottom of the page appears in small type the name, "E. H. Griffith, A. M., F. R. M. S., Director." This soiree was given for the benefit of the Monroe County W. C. T. U., and Mr. Griffith's motto at the head of the programme is "Touch not the glass." Instead of adopting the time-honored custom of placing the exhibitor's name in the first line, the name of the object given, with the number of times magnified, and opposite to this the exhibitor's name and the microscope used. This is the most satisfactory method of cataloging the exhibits which we remember to have seen. Some sixty numbers are down on the list, and nearly every exhibitor showed two slides. On the last page of the programme is a short description of some of the rarer objects seen. Altogether, it was just such an entertainment as the uninitiated could comprehend and enjoy—but what else could be expected of Mr. Griffith?

A SOIREE was given by the Iron City Microscopical Society, of Pittsburgh, Pa., on March 11th. One hundred and forty-two slides were exhibited under forty-nine microscopes, representing the leading foreign and American makes. The programme of the soiree is gotten up in an attractive style, and the names of exhibitors and exhibits indicate a rare treat enjoyed by the friends of the society. We are glad to learn that the Iron City Society is engaged in useful work, and that its membership is increasing.

THE twelfth annual report of the American Postal Microscopical Club is at hand, and shows admirable work done for the past year. The club has increased to such an extent that Mr. H. B. Ward has been appointed Assistant Secretary, with address at headquarters. We have noted several of the boxes as they have come to us, so that our readers already have some idea of the scope of the work, which is proving of great value and assistance to many. We trust that in future particular care will be taken in noting the exact methods of preparation of specimens.

AFTER a period of several years, *The American Naturalist* has again changed hands, this time the well known house of J. B. Lippincot Company of Philadelphia, undertaking its publication. The life of the *Naturalist*, with shame be it said, has many times been endangered for lack of support, but for twenty years it has struggled

on and still survives. We have watched it from near its beginning with much interest, wondering more than once if the scientific men, the teachers of zoology and biology could afford to let it go, and the sequence has proven that they could not. It seems strange that the scientists of this country take so little interest in science outside of the limited sphere of their own pursuits; but that this is so the meagre support gainsaid to special periodicals fully demonstrates. From an English and German standpoint, flooded as those countries are with scientific periodical literature in proceedings, weeklies, monthlies, and quarterly installments, representing the careful work and thought of the greatest of living men, this lethargy on the part of Americans seems incredible. Is it, as the *Naturalist* says, because so many of our scientific chairs in colleges are filled with untrained men? Such journals as the *Naturalist*, *Science*, Dr. Whitman's *Journal of Animal Morphology* and THE MICROSCOPE, deserve most liberal support, and undoubtedly this state will obtain as soon as a knowledge of fundamental methods becomes disseminated among science teachers.

We miss Dr. Packard from the editorial chair of the *Naturalist* which he has so long and ably filled. The new publishers are to be congratulated, however, in securing two such distinguished leading editors as Edward D. Cope and J. S. Kingsley.

The new editors start out with a stirring editorial in the January number, which we hope may prove a bee in somebody's bonnet. Speaking of the teachers and methods of biology teaching in our "four hundred colleges and universities," they say: "The teachers of biology are worthy men without biological training, men whose ideas and methods are those of a generation ago, and who have no more idea of modern science and modern scientific thought than have the poorest of the pupils who are unfortunate enough to come under them." These teachers are mostly clergymen and lawyers who must have some position in their college.

Those who have read the life of Louis Agassiz, will understand in part why his life was so eminently successful. Enthusiasm may accomplish much, but enthusiasm without a sure foundation, built of long and systematic training, is too often only the blind leading the blind.

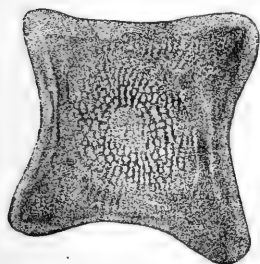
One point upon which we would lay particular stress is that one high road to success in zoology and biology lies through the microscope.

It is with deep regret that we chronicle the death by typhoid-pneumonia of Dr. Bernard Persh, hospital steward of the U. S. Frankford Arsenal, aged 37. Although personally unacquainted with Dr. Persh, he was well known to us through his microscopical work, and lately by his active interest in photo-micrography. His death is a loss to the scientific world.

WE understand that Dr. Thomas Taylor's report for 1886 to the Commissioner of Agriculture contains 114 photo-micrographic illustrations of butter and fats. The photography is in the highest style of the art, and was done by Mr. W. H. Walmsley and the late Dr. Bernard Persh, of Philadelphia. If these photographs are included in the government report, it will make a decidedly interesting volume.

THE push and enterprise of the firm who are now publishing THE MICROSCOPE was well exemplified in our last number. The report of the New York Microscopical Society arriving after the body of the journal had been printed, the publishers not only suggested but offered space in the advertising pages in order that our readers might have an early report of the meeting. That the attempts to make the MICROSCOPE the leading journal of its kind, and a credit to American microscopists, is appreciated, the daily large additions to our subscription lists show. We have room for many more, however, and we trust that all subscribers will see to it that every friend interested in microscopy knows of the existence of this magazine.

WE desire to again call the attention of correspondents and exchanges to the fact that this magazine is no longer published at Ann Arbor. All communications, exchanges, etc., should be addressed to THE MICROSCOPE, 83 Lafayette avenue, Detroit, Mich.



Amphitetras (Biddulphia) Altemans, N. S.

CORRECTION.—The cut on page 65 of the March number of THE MICROSCOPE, which has the name *Cos. Excavatus*, var. *Greville*, should have been labeled, *Amphitetras* (Biddulphia) Altemans, n. s. The mistake was ours, the plates arriving too late for Mr. Christian's inspection.

For the dentist, as well as for the physician, a knowledge of microscopy is almost indispensable, if success is desired. We are glad to notice in several of our exchanges devoted to dentistry, that this branch of the profession is gradually awakening to the importance of the microscope as an aid in the thorough understanding and practice of their specialty.

ACKNOWLEDGMENTS.—From Dr. Brown, London, Ont., catalogue of James Swift & Son, microscopes, etc., London, England. We are glad to see the great improvement in the English stands; the cumbersome, and to us somewhat clumsy, forms of former years are being remodeled, and many American shapes introduced. From J. D. Beck, Liberty, Pa., slides of vegetable sections stained with echein green. This new stain gives an excellent color, permitting a second stain also.

TECHNOLOGY.

PERMANENT PREPARATIONS OF BLOOD.—Amphibian blood.—Spread some fresh blood on a cover-glass upon which has been previously spread some normal fluid. Hold the cover-glass over the open mouth or in the neck of a bottle containing osmic acid for about one minute. The fumes will fix the corpuscles. After the corpuscles are fixed, place on the cover a drop of 75 per cent. glycerin containing alum-carmines and fluoresceine. Then place the cover on the center of a clean slide, and allow it to settle down by its own weight—do not press it down. The alum-carmines glycerin is prepared: Glycerin, 85 cc., Grenacher's alum-carmines, 10 cc., fluoresceine, 5 cc. The fluoresceine is made: Fluoresceine, $\frac{1}{10}$ of a gram; water, 100 cc., chloral hydrate, 2 grams. A fresh solution should be prepared every few weeks. Eosin, $\frac{1}{20}$ th gram, water, 100 cc., may be used instead of fluoresceine. When the cover-glass has settled, place four drops of shellac cement, (shellac added to 95 per cent. alcohol, set in warm place to dissolve and settle, decant clear fluid, and to each 50 cc. of shellac add 1 cc. of castor oil. Thin at any time by adding 95 per cent. alcohol) at equidistant points around the cover-glass so that half the cement shall be on the slide and half on the cover. Allow the slide to lie flat for a few hours, so that the cement may dry and fix the cover. Finally wipe away the glycerin around the edge of the cover-glass with a moist cloth, then place the slide on a turn-table and make a ring around the entire cover-glass. Several thicknesses of the cement should be

put on, but each should be allowed to dry before adding another. (*Gage.*)

Another method which is taught in Heidelberg, (we do not remember the originator's name,) which yields beautiful results, is as follows: Allow fresh blood to fall drop by drop into a solution of osmic acid (2 per cent. acid solution, one part; 1 per cent. solution sodium chloride, two parts; distilled water, one part.) The solution should be constantly stirred while the blood is dropping. Allow the blood and acid to stand over night, and then wash the acid away with distilled water. Add alcohol, then clove oil, in which the blood may be kept indefinitely. Before the alcohol is added the nucleus of the corpuscle may be stained in alun-carmine, the blood afterwards being washed; or the whole corpuscle may be stained in analine blue. We have slides of salamander and dog's blood prepared in this way some years ago, which are as beautiful to-day as when first finished.

Gibbes' method of staining blood is essentially the same as that recommended by Gage. First spread the blood on the cover-glass and expose to fumes or immerse in osmic acid. Then wash with distilled water and cover the blood with the staining fluid, which should be allowed to remain for a few minutes. Gentian violet or rosanilin acetate are recommended as colors. When stained, the blood should be washed in water and then in methylated spirit until no more color is given off. Allow cover to dry and then mount in Canada balsam.

TO SHARPEN RAZORS.—The simplest method of sharpening a razor is to put it for half an hour in water, to which has been added one-twentieth of its weight of (HCl) hydrochloric acid water (which is muriatic acid), or sulphuric acid, then lightly wipe and after a few hours set it on a hone. The acid here supplies the place of a whetstone, by corroding the whole surface uniformly, so that nothing further than a good polish is necessary. The process never injures good blades, while badly hardened ones are frequently improved by it.—*Scientific Enquirer.*

PREPARING HORSE-HOOF.—In Dr. C. Nörner's investigations, (*Arch. für Mikr. Anat.* xxviii, 1886) directed chiefly towards the discovery of nerve-fibres, the hard corneous layers were first removed from the hoof, and then small pieces of the softer tissues were cut out and placed in osmic acid and gold chloride. Pieces of tissues were placed in osmic acid (1 : 100) for 24 to 48 hours, they were then

washed and stained in picro-carmin (in toto). In using the gold chloride, the fresh pieces were first rendered sufficiently transparent by soaking for one to five minutes in one-third formic acid. They were then transferred to a gold chloride solution (1 : 100 or 1 : 200) for 20 hours. After washing, the gold is reduced by putting the pieces in a weak solution of formic acid for 24 hours in the dark. They were then hardened in absolute alcohol and stained in toto in picro-carmin. The sections were first examined in dilute glycerin, and those showing numerous nerves were placed, after staining, in dilute picric acid, then passed through alcohol to oil of cloves, and mounted in balsam. In preparations thus treated the nerves, stained dark violet to black, show up against the red background. The author does not speak encouragingly of either method, as he found that both were unsatisfactory. For examining the histological structure of the hoof, pieces of the softer part were stained in toto in Ranvier's picro-carmin, and were then hardened in alcohol. The sections were then placed in water, slightly acidulated with picric acid, and mounted in balsam or in formic-acid glycerin: or the pieces were first cut and then stained.—*Journal R. M. Society.*

PREPARING THE BACILLUS OF LUSTGARTEN.—M. M. Alvarey and Tavel, (*Arch. de Physiol.* xvii. 1885), have modified Lustgarten's method as follows: Instead of sulphuric acid they use 2 per cent. oxalic acid: a stay of two hours in the warm solution they find sufficient, and they double stain with rosin, picro-carmin, and safranin. They approve De Giacomo's method if the iron chloride be strongly acid. Against Lustgarten they maintain that the syphilis bacillus, like that of tubercle, strongly resists decolorization by acids (33 per cent. nitric, hydrochloric and sulphuric acids.) The authors, however, mention a difference between the two bacilli, which is, that Lustgarten's microbe becomes immediately unstained by alcohol after treatment with acid: the acid must therefore be well washed out in water, if the color is to be retained.—*Journal R. M. Society.*

METHODS OF PREPARING EYES OF MAMMALS, BIRDS, MOLLUSCANS, AND ANTHROPODS.—The eyes of certain mammals used by Dr. A. Dostoiowsky (*Arch. f. Mikro. Anat.* xxviii. 1886), were hardened in Müller's fluids for periods varying from a few days to several months. Many of the eyes had previously been placed for 24 to 48 hours in a 2 or 3 per cent. chromic acid solution. For cutting, the anterior half of the eye was embedded in celloidin used in three different strengths, (thin, medium, and thick). In each of these so-

lutions the preparation was left for at least 24 hours. It was afterwards immersed in a mixture of 2 parts of ordinary spirit and 1 part of water. The direction of the sections was meridional, transverse and tangential. For staining, Böhmer's haematoxylin and eosin were exclusively used. The logwood solution was several months old, and very weak. This device prevented the celloidin from becoming stained. Dr. W. B. Canfield, (*Ibid.*) in his researches on the accommodation apparatus of the bird's eye, employed Semper and Fredericq's method for dry preparation, and also the celloidin process. The eyes were fixed in Muller's fluid, and then hardened in spirit. For decalcification, saturated solution of picric and chromic acid, and nitric acid 2 per cent. were used. The eyes were then embedded in celloidin by Czermak's method, and the sections, stained with haematoxylin and eosin, were mounted in balsam. In elucidating the structure, of molluscan and arthropod eyes (*Mt. Zool. Stat. Neapel*, vi 1886). Mr. W. Patten notes the satisfactory results obtained by the following methods: When sections were not resorted to, the tissues were hardened a very little and then macerated. The use of chromic acid has to be varied in strength and temperature, etc., for different regions: it was found especially useful to shift in half an hour from a one-tenth per cent. to a one-twentieth, in 24 hours back again to one-tenth, in 24 hours to a one-fifth, where it was kept for 48 to 60 hours. The cornea was best treated with picro-chromic, the lens with picro-sulphuric, the layer of nerve-fibres below the septum with one-fifth per cent. chromic acid for 24 hours, the retinophorae with chromic, the rods and the retinidia with one-fifth per cent. chromic at 50 degrees C. for half an hour. The best preparations, with all the parts in the most natural position, were obtained by killing the eyes first with one-tenth per cent. chromic acid for half an hour, allowing them to remain in one-half per cent. for 24 hours, one-tenth per cent. for 23 hours, and finally one-fifth per cent. for 48 hours or more.—*Journal R. M. Society.*

ROSANILIN NITRATE FOR GOBLET AND MUCUS CELLS.—Dr. J. H. List (*Zeitschr. f., Wiss., Mikr.*, III. 1886), now uses a 0.0001 per cent. of rosanilin nitrate for goblet and mucus cells. Sections taken from 50 per cent. alcohol are overstained in the above fluid for ten to fifteen minutes. The superfluous stain is then extracted in absolute alcohol. The nuclear structure, as well as the reticulum of the cell, are well shown. After hardening in chrom-osmium-acetic acid, the chromatin of the nucleus comes out extremely well. The Karyokinetic figures in epithelium are also well shown.—*Journal R. M. Society.*

ABSTRACTS.

FERRUGINOUS SCHIST AND IRON ORES OF LAKE SUPERIOR.—A thorough microscopic study of the ferruginous schist and iron ores of the Lake Superior region is given by Prof. R. D. Irving, in the October number of the *American Journal of Science*. He concludes: (1.) The original form of the iron-bearing horizons was that of a series of thinly bedded carbonates interstratified with carbonaceous shales, not unlike the associations of the iron carbonates of the coal measures with carbonaceous layers. (2.) By a process of silicification the carbonate-bearing layers were transformed into various ferruginous rocks, and sometimes the iron was leached out. (3.) The iron thus removed was redeposited, making ore bodies, or forming the coloring matter of jasper. (4) Where the iron was retained, there may have arisen the actinolitic magnetite schists. (5) The rich ore bodies may have been the result of leaching, of direct oxidation of the original carbonate, or may be unusually rich parts of the magnetite schists. The author seems to be well satisfied that these iron ores are not of eruptive origin, though silicification demands the presence of a considerable heat.

THE EFFECT OF CONTINUED HEAT ON ROCKS.—The effect of long continued heat, artificially applied to certain vitreous rocks, like obsidian and pitchstone, has been investigated by Mr. F. Rutley, of the Normal School of Science, whose paper on the subject has recently been published by the Royal Society. Thin sections of the rocks in their normal condition, and after exposure to heat in a glass furnace, have been studied microscopically, and the resulting changes of structure exhibited in a series of illustrations. It is not likely that in nature rocks are ever subjected to absolutely dry fusion, and hence another series of experiments is to be made, with the introduction of water, so as to imitate as closely as possible the actual condition of nature.—*English Mechanic*.

EXTRACTS FROM THE NOTE BOOKS OF THE AMERICAN POSTAL MICROSCOPICAL CLUB.—To any one who has made sections of limestone fossils, frequently much crystallized, I need not say that sections are made with as little dirt in the mount as possible, but that little may be much. The sections cannot be removed, but must be mounted on the slide on which they are ground. Prof. Nicholson, now of the College of Edinburgh, Scotland, first suggested and put in practice the study of fossil corals by modern scientific methods, viz., by

slicing in three directions and thus getting a general view of the internal structure of the skeleton. The microscope is essential to the study of these Bryozoans, many of which are less than $\frac{1}{100}$ of an inch in diameter and are complete colonies. Such are easily sectioned in the matrix.—*J. E. Stidham.*

It is not wonderful that the student of the *Diatomaceæ* often becomes puzzled in such a labyrinth, when a single line, more or less, or some slight difference in curvature is deemed sufficient to warrant the constitution of a new species.—*C. Henry Cain.*

If the Diatomists were the only persons who delighted in creating species—out of nothing—we should have good reason to be thankful.—*R. H. W.*

The object of this specimen is to demonstrate the assistance of a ring on cover glass in focussing and finding small objects (diatoms). Make an alcoholic solution of any aniline color (for stock). Take a little mucilage of gum arabic, add enough of the aniline solution to color, then with a fine brush and the aid of a turn-table the little ring is spun on a clean cover. The diatom or other object is then placed in the center. Turn the cover upside down on a wooden slide with an aperture in its center, place under the "scope" and stick a little strip of gummed paper on this side so it may indicate to the eye the direction in which the object lies. Then place a drop of balsam on the center of a slide and mount in the usual way. To hold cover-glass on turn-table, make a wooden slide 3×1 in. and mortise two holes $\frac{1}{2}$ inch from center, about $\frac{1}{8} \times \frac{3}{8}$ in., to receive two little wedges of cork, with which the cover may be centered and securely held. I learned this method from Dr. W. A. Clapp, of Indiana. To some of the members it will not be anything new, but as I have not seen anything of the kind in the Club's boxes it might interest and possibly be of use to some of our members.—*Charles Mitchell.*

Since ordinarily an object as delicate as a small louse (from great horned owl), unprepared, is so transparent as to be of little value, I attempted staining this specimen with carmine, with (to me) very satisfactory results. After immersion in dilute acetic acid, mounted it in glycerine as any other object.—*W. H. Currier.*

When on a visit to Baltimore in March, 1886, I was talking with Mr. F. W. McAllister as to why many persons could not see the markings on diatoms. He said because they were astigmatic, and asked why I could not put up a slide of arranged diatoms as a test. This slide will give the direction in which one is astigmatic. Use the lowest powers with which you can see the lines

on *Navicula Lyra*, looking at the center diatom, and you should see the markings on all at once. If you cannot see the lines on any one of the twelve, you should visit some one and have your eyes tested.—*Thomas Christian*.

THE ELECTRICAL DISCHARGE OF THE MALAPTEONRUS ELECTRICUS.—

Mr. Gotch has experimented with a fish brought from the river Senegal, and he found that the discharge on electrical excitation of the skin is not of a reflex character, but is the result of direct excitation of the electrical organ at the point excited.

2. That the latency of the organ under these conditions is extremely short.

3. That the excitatory state is propagated through the organ at a rate of about two and a half metres per second.—*Journal Nervous and Mental Diseases*.

A NEW MICROCOCCUS AS THE PATHOGENIC AGENT OF INFECTIOUS TUMORS; ITS RELATIONS TO PNEUMONIA.—Dr. Manfredi (*Gazette Méd. de Paris*) has recently made some researches in regard to the pathogenic agent of morbillous pneumonia in the case of two persons dead of measles complicated with pneumonia. No autopsy could be obtained, and the experiments were made with the saliva, the lachrymal secretion, and scrapings from the skin. The following is a *résumé* of the results obtained:

In the two cases the sputa contained constantly, and independently of the pneumococcus of Friedländer, a specific micrococcus endowed with very pronounced pathogenic properties, to which he gives the name "*micrococcus of lymphoma or progressive granuloma*," which, when inoculated on animals, gave rise to particular pulmonary lesions analogous to those of pneumonia. From the lack of microscopic examinations and on account of the small number of cases on which the researches were based it is not yet possible to say what part this microbe plays in the pathogenesis of secondary morbillous pneumonia.

The micrococcus has an ovoid form, is often seen as a diplococcus, and measures about 0.5μ . It develops tolerably well in all the common cultivating media, and the growth of the cultures is very rapid when air is freely furnished. On thick gelatin, on which typical cultures are obtained, the colonies are presented as discs, first thin and of a blue tint, then thicker and of a pearl gray color, with excavated borders and almost always a nacreous reflex on the surface. The growth and multiplication of this micrococcus causes a very

marked rarefaction of the cultivating medium. In studying the influence of temperature and dryness on the cultures, it was found that the micrococcus develops in two distinct forms: a transitory and a more permanent.

Inoculation experiments were made on dogs, rabbits, guinea-pigs, mice, and birds. With the exception of the last, which succumbed to what seemed to be blood poisoning, all the animals presented only one form of pathological manifestations, which was most clearly seen in the rabbits and guinea-pigs. Of a total of eighty animals experimented upon, only four were refractory and escaped fatal consequences from the inoculations. The micrococcus possesses very pronounced infectious power, which seems to be chiefly exerted upon the respiratory apparatus. This virulence is endowed with a capacity of resistance which is remarkable, persisting in the cultures for several months, and resisting successive passages through the animal organism, as was shown by series of inoculations on the animals. It resists desiccation to a marked degree.

As a rule the animals died from the seventh to the twelfth day. At the autopsy there was enormous tumefaction of the parenchymatous organs, principally of the spleen and lymphatic ganglia. The tumefied organs were studded with gray or grayish-yellow nodules. Independently of the nodules the lungs contained the characteristic lesions of a more or less extensive pneumonia, even in the stage of hepatization, even when the inoculation was made in the subcutaneous cellular tissue. The nodules belonged to the class of granuloma, or infectious tumors with granulations. They usually go on to calcification, which begins at the center; they contain the specific micrococci, and are infectious.

This new micrococcus usually leads an intracellular existence, and its pathogenic action consists in provoking caseous necrosis of the parenchyma of the cellule. More rarely they are found outside the cellular elements, and very exceptionally in the vessels. In the foci of degeneration and necrosis developed about it this micrococcus is not killed, for it can exist in a state of great rarefaction or dilution of the elements necessary for its existence.

The pathogenic action of this schizomycete is exerted principally on the lymphatic system, which represents at the same time both the port of entry of the infection and the most favorable medium for the development of the infectious agent. When the latter is inoculated into the subcutaneous cellular tissue there is formed, at the seat of the inoculation, a nodule which often grows very large, and which is made up of a plastic exudate on the way to caseation. It

is in the center of this nodule, which is the center of a violent inflammation, that the lymphoid cells are penetrated by the micrococci, and thence transported to the lymph vessels in the vicinity. Along these vessels there are formed a series of small disseminated inflammatory nodules; and thus the whole system becomes infected.—*Journal American Medical Association.*

HISTOLOGY AND PHYSIOLOGY OF CILIATED EPITHELIUM.—Following up the experiments which Prof. Grützner made upon injured ciliated mucosa, in which it was seen that the injury affected only the portion below the cut, Herr A. Lust has studied in the living organism, the exact changes exhibited by the adjacent cells. In the pharyngeal and oesophageal mucosa of living frogs, definite injuries were cleverly effected by means of burning, and Grützner's results were confirmed. The ciliated areas or grooves in the normal skin, above the injury, are described and contrasted with the appearance of the adjacent area below. The ciliation is stopped or checked, moribund pulsations are abundantly observed, the ciliated areas or grooves are less definite, and the color of the affected area is turbid and slightly yellow. The mucous cells exhibit marked modifications, *e. g.*, a marked abundance of disproportionately large granules, and a longer, narrower shape. In the ciliated cells, the cilia disappear or become fused together, or become, less frequently, markedly smaller, as Drasch has already noted. The epithelium generally is much less conspicuous, and the ciliated grooves much flatter. The investigation, which cannot yet be regarded as complete, was extended to other amphibians and to the rabbit.—*Journal R. M. Society.*

THE CIRCULATION OF THE BLOOD IN THE GANGLIONIC CELLS.—Prof. Albert Adam Kiewics has made a searching examination of the blood supply of the ganglia, his experiments being confined more particularly to the intervertebral ganglia connected with the cords forming the brachial plexus. The vessels supplying these ganglia were injected with carmine through the spinal arteries, with the result of showing that each cell is supplied with blood by means of a separate arterial loop so disposed as to invest the ganglionic cell, which is thus bathed in the arterial blood, much as the placental tufts are bathed by the blood in maternal sinuses. The cell itself, moreover, is said to contain minute ramifications of passages from the circumference to the center, through which semen alone can penetrate.—*W. K. Medical Review.*

NEWS AND NOTES.

M. FARABEUF succeeds M. Sappey as Professor of anatomy in the Paris faculty.

FRANCISCO MAGNI, formerly Director of the Anatomical School at Florence, but recently Professor of Ophthalmology, at Bologna, died at San Remo, Feb. 2, aged fifty-nine.

THE Spanish Government intends to erect a laboratory for research in bacteriology in Barcelona, under the control of Ferran. A Pasteur Institute will be built and equipped by the Italian government in Palermo, the director of which will be Professor Celli.—*Phila. Medical News*.

A NEW work on the "Fresh-water Algæ of the United States," by the Rev. Francis Wolle is in press. It will contain 150 plates, with over 2,000 figures.—*Bot. Gazette*.

Mr. John Kruttschnitt, of New Orleans, has an interesting paper on "Observations on the Sarraceniacear or Pitcher Plants," in the January number of the *Journal of Education*. As this article was originally intended for THE MICROSCOPE, we regret that it wandered into other print.

AN interesting paper on "The Evolution of the Special Senses," by W. C. Cahall, M. D., appeared in the August *Journal of Nervous and Mental Diseases*.

THE Macleay natural history collection, University of Sydney, is valued at \$125,000. A sum of \$30,000 has been promised for the endowment of a curatorship in connection with it.

THE *Dental Review* for December, January and February contains an interesting illustrated article on the periosteum and peridental membrane, by G. V. Black, M. D., D. D. S.

SIR WILLIAM DAWSON will prepare a volume for the International scientific series on the subject of the development of plants in geological time.

PROF. WEIGAND, the well-known botanist of Marburg, whose death was recently announced, was a voluminous writer, not only on botany, but also on microscopical subjects. Of late he fought, like Agassiz, against Darwinism.—*Western Druggist*.

DR. SALMON states that he has certainly found the microbe which is the cause of the swine plague. It is a bacterium and produces all the symptoms of the disease when hypodermically injected into the pig.—*Amer. Pract. and News*.

MR. C. E. PELLEW recently presented a paper before the New York Academy of Sciences, on "Recent Investigations on the Mitigation of Pathogenic Bacteria." The paper was illustrated by the stereopticon and microscope.

THE famous Indian botanist, Babu Havinohun Mukerji, of Bengal, is dead. He was at one time head-master of a small agricultural school attached to the botanical gardens of Sibpur, but left it to pursue his wanderings in search of Indian plants in the northern and eastern districts. He was the author of several botanical works.—*Engl. Mechanic*.

MM. A. CERTES AND GARRIGON recently presented a communication, before the Paris Academy of Sciences, on the constant presence of micro-organisms in the thermal waters of Luchon (64°C) and on their action on the production of baregine. The object of this paper is to determine the presence of living organisms in thermal waters of the highest temperatures, to ascertain their nature and the part played by them in the production of the bargine or glarine commonly found in sulphurous waters.—*Nature*.

THE histology of the skin and the lateral-line organs of the electric catfish is described by Fritsch in a paper before the Berlin Academy of Science, April, 1886.

DR. R. W. BISHOP, of Chicago, has been investigating that American characteristic, premature baldness, and asks, in a paper presented before the medical society of his city, if the condition is contagious? The doctor thinks that the disease is due to micro-organisms upon the shafts of the hair, and that it is contagious. He has made a series of experiments, assisted by Dr. Oscar Lassar. A typical case was that of a perfectly healthy young man whose head was nearly bald on top. The hair from the diseased surface was brittle and came out easily when pulled. Microscopic examination revealed a large number of fungi on the scalp and the shafts of the hair, the root being free from the parasite. The diseased hairs were cut and mixed with vaseline, which was rubbed on the skin of healthy rabbits, and in two weeks the hair entirely disappeared from the parts which had been rubbed. Experiments were continued, and it was found that the hairs from the inoculated animals possessed increased virulence.

During the last ten years between 1,100 and 1,200 new plants from Madagascar have been described in the *Journal of the Linnean Society* and *Journal of Botany*. Twenty-nine of these are new genera.—*Bot. Gazette*.

DR. ISAAC LEA, among the oldest and most prominent of American Naturalists, died on the 8th of December. He was born in 1792, and devoted his life, with the exception of a few earlier years, to a most successful pursuit of Natural Science. His name is preserved through his studies of fresh water and land shells. He bequeathed his valuable collection to the National Museum in Washington.

DR. E. L. YOUNG, the projector and editor of *Popular Science Monthly*, has just died, in his 66th year. In defining the purpose of his monthly, he wrote "The work of *creating* science has been organized for centuries * * * The work of *diffusing* science is, however, as yet, but very imperfectly organized, although it is, clearly, the next great task of civilization." Though, himself, an original thinker, his best work was devoted to the *diffusion* of thought, the value of which cannot be over-estimated. He was also chiefly instrumental in introducing the works of Herbert Spencer in this country.

ALFRED R. WALLACE, LL. D., of London, recently delivered four illustrated lectures at the Peabody Institute, Baltimore, on "The theory of development," and "The origin and uses of colors in animals and plants."—*Science*.

THE Agassiz Association has at last an organ in *The Swiss Cross*. This handsome journal is edited by the President of the Association, Mr. Harlan H. Ballard, and will doubtless prove a well-spring of information to the members. The frontispiece of the January number is a very fair portrait of Louis Agassiz, and the contents full of interest.

M. PAUL BERT, who died recently in Tonquin, was born in 1833, graduated a doctor of medicine in 1863, a doctor of science in 1866, and a licentiate in law at about the same time. He was at one time assistant to Claud Bernard, and from 1867 to 1869 filled the chair of physiology at Bordeaux, being afterward called to the professorship of physiology in Sorbonne. M. Bert was well known as a writer, and his contributions to the literature of human and animal physiology were extensive and original.

MR. WM. ELLIOTT finds that *Volvox globator* is well preserved in a solution of common salt in distilled water. The specimens retain their shape and color, and are well adapted for low powers.—*Jr. of Microscopy*.

THE Pharmaceutical Society of Brooklyn, in its lectures to drug-clerks, includes a course on the microscope in pharmacy.

THE November number of the *American Monthly Microscopical Journal* contains two valuable papers read before the A. A. A. S., by Drs. Theobald Smith, and D. E. Salmon.

BOOK REVIEWS.

THE PHYSICIAN'S LEISURE LIBRARY, Detroit; Geo. S. Davis.

Three more numbers of this excellent series have been received, viz.: The Physiological, Pathological and Therapeutic Effects of Compressed Air, by Albert H. Smith, M. D.; On the Determination of the Necessity for Wearing Glasses, by D. B. St. John Roosa, M. D.; and, Granular Lids and Contagious Ophthalmia, by W. F. Mitendorf, M. D.

The study of the effects of compressed air is comparatively new and Dr. Smith, as surgeon to the New York Bridge Co., has had peculiar opportunities for its prosecution. The study of the physiological and pathological effects produced in men when subjected to great atmospheric pressure is a necessary step to the determination of the therapeutic value of such a pressure artificially produced. Dr. Smith's little monograph well repays careful reading. The volumes on diseases of the eye are timely and will afford excellent guides to the practitioner removed from easy access to the specialist.

PRIMER OF THE CLINICAL MICROSCOPE, by Ephraim Cutter, M. D., Boston, Charles Stodder, 1879. pp. 24. Price 50 cts.

This little work although first published eight years ago, contains much valuable information for the beginner, upon which time and progress can have little effect.

MICROSCOPY. Four reprints from *American Naturalist*, from Dr. C. O. Whitman.

A CONTRIBUTION TO THE HISTORY OF HYDRAMNIOS, by Robt. T. Wilson, M. D. Reprint.

RESEARCHES INTO THE ETIOLOGY OF DENGUE, by J. W. McLaughlin, M. D. Reprint.

DIAGNOSIS OF CONSUMPTION BY MEANS OF THE MICROSCOPE, WITH REFERENCE TO LIFE INSURANCE, by Ephraim Cutter, M. D. Reprint.

CORRESPONDENCE AND QUERIES.

DR. C. A., BOULDER, COL.—1. Address the Manager, Dr. R. H. Ward, Troy, N. Y., American Postal Microscopical Society.

2. For methods of staining blood corpuscles, see Technology, this number.

3. See page 83 of THE MICROSCOPE for the current year.

4. In examining urinary casts, gentle pressure on the cover-glass by means of the finger or teasing needle, will cause the cast to roll so that all sides may be seen.

4. We have never been troubled by mucus in the way described. A little mucus is sometimes desirable as casts, crystals, etc., become entangled in the threads and may then be readily detected. You use too coarse a pipette. Try Squibb's *minim nipple* pipette.

6. We have used equal parts of glycerine and camphor water for preserving urinary sediments. Another preservative, recommended by Prof. Woods, of Harvard Medical School, which is excellent, consists of acetate of potassium with a little carbolic acid. It is desirable that the acetate have a Sp. gr. between 1,050 and 1,060, and should contain carbolic acid in proportion of 4 or 5 cc. of the deliquesced acid to the liter of solution.

Casts may be stained with eosin. Wash the sediment with distilled water, then cover for half an hour or longer with eosin in proportion of 5 grains to the ounce of water-alcohol (3 to 1). Wash again, and place a drop of the stained sediment on a slide. Dry; wash with alcohol, clear with turpentine or other agent, mount in balsam. Or, mount in the glycerine-camphor, Farrant's solution, or Wood's preservative. In this instance the cover-glass must be sealed.

7. The eye-piece mentioned can be used, but it is bad practice to increase magnification in this way. Use a higher power objective.

8. The dropper in the cork bottle for stains has long been in use.

9. The word *micron* was introduced by Listing in 1869 as the name of the unit of measure in micrometry, viz.: 1.1000 of a millimeter. The Greek letter μ is used to designate micron.

10. The number of glomeruli in the human kidney has not been computed.

11. If physicians are, as a rule, poor microscopists, it is certainly their privilege, as well as duty, to support such a journal as THE MICROSCOPE, which deals with every aspect of this great subject. We are always glad to answer all questions of general interest, and will give as much attention to such inquiries as space permits.

S. K. J., NORFOLK, VA.—Celloidin is a pure pyroxylin soluble in equal parts of absolute alcohol and sulphuric ether. It comes in chips and tablets, the former being preferable for microscopic use. It may be obtained of Bachrach Bros., Baltimore, Md.

THE MICROSCOPE. EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be given ONE INSERTION FREE OF CHARGE. Dealers are referred to our advertising department.

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FOR EXCHANGE—Vols. 4, 5 and 6 of The Microscope, unbound, postpaid. Who will give the most mounted slides?
C. A. RAYMOND, Gaston, Washington Co., Ore.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,
At 21 State Street, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 83 Lafayette Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. Box 583, Detroit, Mich.

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VOL. VII.

DETROIT, MAY, 1887.

No. 5

ORIGINAL COMMUNICATIONS.

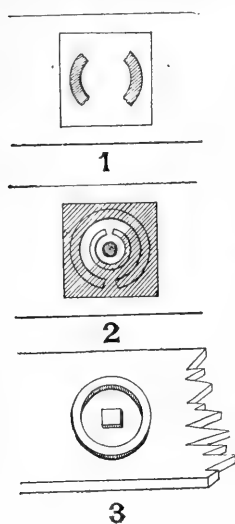
SOME SIMPLE LIFE-SLIDES—A PERSONAL EXPERIENCE.

DR. ALFRED C. STOKES.

AS the Editor of THE MICROSCOPE has done me the honor to ask for a description of the life-slides, growing-cells and similar contrivances that I use in the examination of minute animal life, I cheerfully comply with the request, although the little "dodges" are all simple and all easily made by the microscopist himself. They are furthermore probably familiar to the reader, since they are only such as would be likely to occur to any worker with the microscope. In the writer's case it adds an indefinable charm to his observations if he can make his own tools, however simple or inartistic they may be, or however roughly finished. Elegant contrivances and costly ones can be purchased, but I have found that hastily-made and home-made productions are often more satisfactory in results than the elaborate affairs offered by the opticians. The following paragraphs are therefore descriptive of the home-made life-slides which the writer has for some time had in daily use, and has thus far found to be all that is needed for his own work. The reader will, I hope, forgive the frequent appearance of the first personal pronoun singular. There seems to be little harm in saying "I" when you mean it.

In most cases I take for covers large thin glass squares only. There are several advantages to be had in their use in this connection over that of thin circles, one being the facility with which the water supply can be renewed. By carefully adding, with a camel's hair brush, a drop of fresh water at the corner of a large square cover projecting beyond the cement cell, the fluid will usually flow

under so gradually that the object, even a minute Infusorian, will not be moved from the field, the inward rush of the current being tempered by the cement ring. This supply can be easily added by one hand holding the wet brush while the eye is intent at the ocular, the secret of success here being in not having too large a brush and in not filling it too full of water. At the beginning of daily evening work the brush is wetted and thrown on the table to become thoroughly moistened, when a single dip into the tumbler, with a slight shake to prevent dripping, takes up enough, although some pressure of the brush against the slide may be needed to squeeze out a small drop. It is better to make several journeys to the tumbler than to lose the object. A dipping-tube adds too much at once, and cannot be so readily controlled as a brush.



In studying the morphology of minute animal organisms, I use only a shallow, shellac cell with about one-fourth of the ring scraped from both the upper and the lower margins, thus leaving two curved supports for the square cover, one on each side. (The diagram, Fig. 1, shows the arrangement, the shaded parts representing the remnants of the cell.) This gives the enclosed drop with its animal life plenty of air, and facilitates the application of the wet brush at the point where the square cover projects beyond the lateral cell wall. In this simple affair I have frequently kept Infusoria and other small creatures alive and well from early in the evening until after midnight, and when compelled to leave them have washed them into

the aquarium in as good condition and as lively as when first imprisoned. Here the secret of success consists, I think, in leaving enough of the cement ring to properly support the cover, and to lessen the force of the inflowing water supply, and also in having the cell shallow or deep according as the animals are microscopically small or large. Much depends on the depth of the cell in all cases. A comparatively large Infusorian, a Rotifer or a *Chaetonotus* can be injuriously hampered in its movements and in the proper performance of its functions by a cell of insufficient depth, and a good objective can, as the reader knows, be greatly hampered in its functions by a cell of too great depth.

If it is desired to convert this or any other slide of the kind into a growing-cell, it is done by the well-known method of placing the slip across a small saucerful of water, with a doubled and twisted thread of sewing-cotton in close apposition with the edge of the cover, both ends of the thread hanging freely in the water. The latter will flow up and supply that lost by evaporation, provided the water is always in contact with the lower surface of the slide. This "dodge" is successful for a few days, but it always ends badly, as the salts in the water will crystallize at the cover margins and cut off the oxygen supply.

It often happens that the conditions and the environment are such that an immense number of minute Infusoria, all belonging to the same species, are suddenly developed in the aquarium, infusion or maceration, and it becomes interesting to isolate a few to study their life-history. Such an advent of Monads, Heteromitæ and other similarly minute creatures is not rare. For the study of such truly microscopic objects the writer devised a simple life-slide, describing and figuring it in *Science Gossip* for January, 1884, from which paper I shall quote without using inverted commas. To make this, cement with Canada balsam in the center of a slip a thin circle $\frac{1}{4}$ inch or less in diameter; use a $\frac{3}{16}$ inch circle if possible. In the latter case then take a glass or zinc or other kind of ring with a quarter-inch aperture, break a small piece from one side, and fasten this broken circular band about the central disc. From another ring with a $\frac{3}{8}$ inch or larger aperture break a piece as before, and cement this broken band around the inner ring so that its broken part shall be opposite the unbroken curve of the latter, and, with a thin, square cover, the cell is complete, the depth depending upon the difference in the thickness of the rings and the central circle.

To use, place on the central disc a small drop of the water containing the organisms to be kept alive, and over it arrange the square cover, taking care to prevent the water from overflowing into the inner, annular space. With the camel's hair brush carefully, and in small quantities, add fresh water at the top or side of the square, never at the bottom or near the opening in the outer ring. It will be found that the water will flow between the square and the upper surface of the exterior ring, will enter through the break in the latter, partially filling the outer annular space, and by capillary attraction will occupy a part of the vacancy between the cover and the interior ring, [as shown by the diagonal lines in the diagram, Fig. 2,] but unless too much water is used or is supplied in too

great quantities at once, it will not pass through the opening in the inner ring, thus leaving an abundance of air to supply the animals under observation. The imprisoned air at once becomes saturated with moisture, as evidenced by the fogginess of the cover; the central drop cannot evaporate, and the external water will not come in contact with it if care be taken in filling the slide and in supplying that lost by evaporation. To admit entirely fresh air the water can be drawn off by bibulous paper, or allowed to evaporate, without in any way disturbing the central drop. The reader must remember, however, that it is intended for only the smallest of microscopic animals, with which it is entirely successful.

I think it was in the proceedings of the Cleveland meeting of the American Society of Microscopists that Mr. J. H. Logan described an excellent life-slide which I have used a good deal and successfully, but as it has some characteristics that render it scarcely adapted to my needs, I have in a rough way made, on Mr. Logan's principle, an imitation which answers my purpose better than the more ornate slides supplied by the inventor. My friend Dr. T. S. Stevens of this city (Trenton, N. J.) tells me that he has kept Rotifers for a whole month alive and well in Mr. Logan's slide, the Rotifers (*Furcularia*) depositing eggs and apparently flourishing as if in entire freedom. For my own purpose, however, the slide is objectionable because it is so heavy, the central disc is so extremely thick that no sub-stage condenser can be focussed through it, and the annular depression so deep that the glass sides affect the light in an undesirable way. For comparatively large aquatic objects to be examined with a low power it is admirable, but I find my own modification of it better for my own work. A small square, cut from glass of any desired thickness, is cemented with Canada balsam to a slip, and surrounded by a thick glass or zinc ring so as to leave a wide space between these parts. On the ring place a ring of wax and, after the object has been arranged on the central square, cover the whole with a thin circle and cement it fast by running a warm wire around the edge to melt the wax. A small drop of water may be placed in the annular space if desired. The reader of course understands that the thickness of the slip and square, and the depth of the cell must be determined by each worker according to his needs. For myself I have them as thin and shallow as possible. [A diagram of the contrivance is shown in fig. 3.] The secret of success here is, to be sure, that the joint between the ring and the slip is air-tight, and to firmly secure the cover, using an abundance of wax.

For showing living Infusoria, Rotifers, Chætonoti, aquatic worms and other animals at microscopical exhibitions, nothing could be more satisfactory than Mr. Logan's slide. Using one at the last soiree of the Trenton Natural History Society the writer kept a quantity of Turbellarian worms well and active until the small hours of the morning. In this instance the slide was prepared so hurriedly and so late that the cement was not dry before the hour of the exhibition arrived, but an external application of the thin and rapidly drying Brown's rubber-cement made all tight and apparently not unpleasant for the worms.

With these little contrivances of various sizes and depths, at all times on my table, one or more is in constant use, and although not particularly handsome, they are not unsatisfactory. If the reader should find them useful I shall be glad, and the Editor will then not regret the space he has placed at my disposal.

STAINING AND MOUNTING PLANT SECTIONS.

C. WELLINGTON.

STEMS of all kinds should, if possible, be cut when fresh. If they cannot be obtained in this state, they may, previous to cutting, be soaked in cold or tepid water, or in a mixture of equal volumes of alcohol, glycerine and water. Fresh stems or roots can be preserved in this medium for almost any length of time, and will remain in excellent condition for the section knife. Wood sections require bleaching before being stained. The bleaching solution is made by mixing one-quarter oz. of chloride of lime with a pint of water, shaking occasionally for an hour, and after allowing the sediment to subside, decanting the clear solution. The process of bleaching should be carefully watched and stopped when complete. Tissues vary so much in color and density that no fixed time can be given for bleaching them. Very thorough washing is necessary. Mr. A. J. Doherty, in a paper to the *Northern Microscopist*, describes at some length the method of staining in carmine and green. The art consists of five stages, or processes: First, decolorizing the section; second, washing the same; third, preparing for staining; fourth, staining in carmine; fifth, staining in green. After bleaching and thoroughly washing to eliminate all the chemicals in order to obtain deep colors, the section must be steeped in a mordant composed of a ten per cent. solution of alum and water for twenty-four hours, at the end of which time they will be ready to be placed in the first staining fluid, the formula for which is as follows:

carmine, 10 grs.; ammonia, 10 grs.; water, 2 oz. The carmine is to be dissolved in the ammonia over the flame of a spirit lamp, the water added next and the fluid filtered before it is used. Put the sections in this stain for eight or ten hours, then take them out and wash in not more than two changes of water, and finally transfer them to the green stain. For this take aniline green, three grains; absolute alcohol, one oz. Dissolve in a test tube, using slight heat only, and filter before using.

Put the sections in this stain for three or four hours, and then mount without delay, after having washed the superfluous color away with methylated spirits. The sections having been well washed, are soaked in absolute alcohol for an hour, then removed to oil of cloves, and allowed to remain in this for about twenty-five or thirty minutes. At the end of this time transfer them to oil of turpentine for about the same time. They are then ready for mounting in balsam or damar.

Staining in picro-carminé is the most truly selective of any double stains yet employed. A special modification of the usual formulæ is required for wood sections, as follows :

Picro-Carminé Solution—Carminé (finest), 2 grains; liquid ammonia, one-half drachm; distilled water, 1 oz.

Put the carminé in a two ounce stoppered bottle, pour in the liquid ammonia and shake occasionally until dissolved, then add the water.

Picric acid, 8 grains; alcohol, 1 oz.

Dissolve the picric acid in a test tube, using gentle heat; then mix with the solution of carminé.

Wood sections stained in picro-carminé are very beautiful, the structures being well differentiated. Sections thus prepared are soaked in alcohol for a short time and then removed to clove oil and mounted in balsam.

THE MOVEMENT OF DIATOMS.

CORNELIUS ONDERDONK.

THE first visible manifestation of life is motion. Whence this mysterious motion or how it first seizes on dead matter we may never know. This, however, the microscope reveals—that motion is the first sign life gives to the intelligence of man.

The mysterious substance called protoplasm lies at the very portal of differentiation; behind this form of matter the wisdom of man has not yet penetrated, and, indeed, although he calls this form

of matter by a name, he too often contemplates it with the stare of stupidity, as he would a phantom from the spirit world, rather than with the glance of intelligence. And here let me say that though I may give no new thing to the scientific world, and though men may call my theory a delusion, yet if I succeed in directing their attention to a more careful investigation of this protoplasm I have not written in vain.

It is several years since protoplasm was named ; its first discovery cannot well be traced, for no doubt men saw the substance before they named it.

That motion appeared to accompany protoplasm has been admitted for years, but that living protoplasm was matter in rythmic motion and dead protoplasm matter at rest, is scarce yet a theory, although it has been surmised by a few advanced minds.

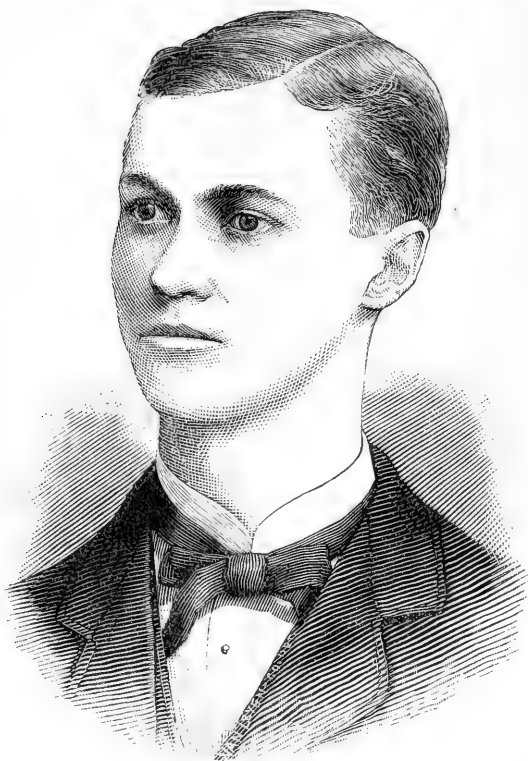
The theory, as such I offer it, is, however, well nigh proven by the movements of the diatomaceæ, and in fact by cyclosis, for I hold the two to be identical in function, though not in environment ; for whilst what we call cyclosis takes place in the interior of a cell, the same function takes place on the exterior of the diatomaceæ. In the former case the rythmic motion of the protoplasmic coating on the inside of the walls drives the fluid that enters the internal spaces of the cell in currents hither and thither. In the latter the same rythmic motion on the outside of the walls drives the fluid and small particles that come in contact with the protoplasm along the walls, and of course also induces a motion to the frustule when free.

That all living diatoms are encased in protoplasm can be proven beyond a doubt. Aniline green stains protoplasm blue, instantaneously, it may be said. This dye will stain no dead diatom shell, but all living diatoms take the blue tint at once on coming in contact with it. The stain also hardens protoplasm, hence the motion is stopped at the instant of contact. Further, I have in many cases seen the layer of blue, hardened protoplasm, slowly unwrap, as it were, from the now dead frustule. I have even mounted the ghost-like mantle, but have not succeeded in preserving it long. When the protoplasmic layer first begins to spring away from the walls of the frustule by virtue, I take it, of the elasticity acquired by hardening, its form is suggestive of an insight into the rythmic motion, for it first appears in very minute ridges, thus AAAAAA. These straighten out, and the mantle becomes much too ample for the form it covered. The protoplasmic envelope is seldom entire. In most cases it covers the valves in two bands, being deficient or wanting on the hoop and median line in the navicula forms. I

said that all diatoms take the stain when living : all with which I have experimented do, these embracing all those generally found in fresh water. The fixed forms, however, as well as the discoidal take the stain more faintly, and in these the covering does not, so far as I have observed, leave the frustule.

We know no reason why cyclosis should take place on the inside of a cell wall. The phenomenon was first observed there for the reason that men became confused on the subject of the diatomic movement, owing, perhaps, to the secondary movement communicated to the organism itself, than that the one mode was not as common as the other in the protophyta. As to what cyclosis is, we can conjecture that it is a necessary motion communicated to the fluid from which material is formed for the use of the force we call life, for the purpose of bringing the particles of matter sought more readily in contact with the forming power. Further than this we, in our present knowledge, cannot go. If we attempt to lift this shadow-veil drawn on the dim boundary of human knowledge, we must repeat the sublime, though childish, Hebraic enunciation, God did it, or hold our tongues until we have more light. There is still, however, vast room for investigation this side of that boundary. Men have paid too little attention to functions, modes and environments, and too much to type, form and nomenclature. Perhaps, because the latter were more gross, material—not so elusive as the former. Men will mark out roads for nature to travel, and insist on nature walking therein. Witness the long attempts to have diatoms move by a stream of water pouring in one end and out of the other. How absurd must such a theory seem to any intelligent man who will carefully watch the diatom cell with a good glass one hour ! He will see that small particles are carried from one end of the frustule like chips on a little rippling current ; he will see larger particles pushed and pulled as if the little form had feet and hands ; now the particle moves, and now the diatom ; now both are at rest, the rhythmic motion changes direction ; now again they grapple like two sentient beings contending for the mastery, nor is there rest for diatom or particle so long as they are in contact. The observer can see that the force exerted is immediately *on the surface* of the diatom, that this force is exerted *over the surface* from end to end of the diatom, and that the force is *rhythmic* and changes the direction of the push or pull, whatever he calls it. Then he arises and admits the stream of water theory because his fathers did, notwithstanding he says he didn't see it. And is it not too much trouble to think on what he did see ? If he had seen the lines on pellucida no thoughts would be required.

Our modern science tried too hard to eliminate thought from investigation. Induction is sneered at as if the process of thought can be dispensed with. Facts only are insisted on, as if facts meant anything only so far as they become subject to the inducting and deducting power of mind.



ALLEN Y. MOORE, M. D.

BY C. M. VORCE, F. R. M. S.

ON the 16th of April, 1887, there passed out of this life one of the most widely-known and esteemed of the younger men who have become prominent in microscopical science. As a contributor for several years to the microscopical journals he was well known by reputation to almost every microscopist in this country and to many abroad. As a member of the American Society of

Microscopists he was personally known to a large circle of the most advanced workers in microscopical research, and by his extensive correspondence was brought into relations of close friendship with many who seldom appeared at the annual meetings. He was one of the original members of the Cleveland Microscopical Society, which contained no more active, earnest or valued member. He was seldom absent from its meetings, and his contributions to its proceedings, in addresses and debates, were always anticipated with interest, and listened to with admiration, owing to the complete mastery of his subject which he invariably displayed, for he spoke upon no subject which he did not thoroughly understand in all its aspects, and followed the same rule in his writings for the press, as the readers of his articles can uniformly attest.

As the possessor of a marvelous technical and manipulative skill in microscopical work Dr. Moore had not only a national but an almost world-wide fame from the rarity and perfection of his preparations and the elegance of appearance he imparted to them, his electrical slides, minute Geisler tubes, silver-plated and gold-plated diatoms, stained diatoms, stained crystals, etc., being especially well-known both in Europe and America. He was the first to successfully double stain nucleated blood corpuscles, his formula for which was published in *THE MICROSCOPE* (vol. ii., p. 73), and was adopted by Cole of London, for the slides of blood sent out by him in his series of typical preparations.

It was, however, in relation to the optics of the microscope and its accessories that Dr. Moore's labors and acquirements were most valued by those who knew him and his works. In this line he had no superiors. He understood perfectly the qualities and the construction of lenses, prisms and reflectors, and was able to formulate the curves and dimensions and the refractive index of all the lenses of any objective or given combination of lenses. If an objective of certain power and qualities were required he could furnish the complete and correct formulæ for its manufacture. His latest work in this line was the production of the formula for a concave lens of excessive minuteness to be applied with a fluid of peculiar composition to the front of ordinary high power objectives, by which means he increased the aperture of the objective immensely.

Dr. Moore was born at San Diego, Cal., July 12th, 1860, and was, therefore, less than twenty-seven years of age at his death. That a career of such brilliant promise should at so early a period

be cut short can but fill us with the deepest regret. His studies in microscopy having extended over a period of but fifteen years, and been productive of such rich and valuable results, inspired his friends, and he had no acquaintances who were not such, with such high anticipations for his future usefulness and prominence that their bereavement by his death is a most crushing blow.

For some years Dr. Moore had held the chair of Microscopy and Histology in the Cleveland Homœopathic Hospital College, which he filled with exceptional ability and success, his teachings, like all his work, being markedly thorough and complete. Although a regularly graduated physician he had never entered into the general practice of his profession, but had taken up as a specialty analytical microscopy, with special application to pathology, in which he had a large and rapidly increasing practice among physicians of Ohio and adjoining States.

Dr. Moore left a widow, and, his nearest relatives surviving him, a father, Col. Moore, of the U. S. Army, and a married sister residing at Coldwater, Mich.

RESOLUTIONS OF THE CLEVELAND MICROSCOPICAL SOCIETY IN REGARD TO
THE DEATH OF ALLEN Y. MOORE, M. D.

WHEREAS, For the second time in the history of this Society the visitation of Providence has removed from our midst by death one of our most valued members and personal friends, in the person of Allen Y. Moore, M. D., who died April 16th, after a brief illness; and

WHEREAS, We, the members of the Cleveland Microscopical Society, desire to express our heartfelt sorrow at the decease of our esteemed fellow member and our sympathy with the bereavement of his relatives and friends; therefore

Resolved, That in the death of our lamented friend and member, Allen Y. Moore, M. D., this society has suffered the loss of one of its most earnest and valued members, whose labors and studies in microscopical science, and whose unwearied interest and efforts in the work of this Society have contributed largely to its success, and greatly sustained and encouraged the interest of his fellow members. And the science of microscopy has lost an earnest, devoted and an energetic and original investigator, whose researches have advanced in no small degree the store of knowledge upon which the useful and reliable use of the microscope depends.

Resolved, That in the death of our deceased member we feel the loss of a genial friend, endeared to us personally by his many estimable qualities of mind and heart.

Resolved, That our warmest sympathy is extended to his bereaved family and relatives, whose loss so far overshadows ours, who are called upon to mourn not only their beloved one, but his removal from his field of usefulness at a time when his marked abilities gave promise of distinction and increased usefulness to science and his profession.

Resolved, That a copy of these resolutions be forwarded to his family and to the American Society of Microscopists, and furnished to the press and microscopical journals for publication.

Resolved, That a suitable memorial be prepared and spread upon the records of this society.

PROCEEDINGS OF SOCIETIES.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE regular semi-monthly meeting of this Society was held March 9, at its rooms, President Wickson in the chair. The subject appointed for discussion, viz: "*Bacillus Tuberculosis* in Fowls," was introduced by Dr. Stallard, who said that the close analogy existing between certain diseases found in many domestic animals and in the human race had long been known, as was also the communicability of such diseases. Rabies was a case in point, and, in a lesser degree, the disease known as anthrax or charbon. It is a known fact that typhoid fever has been transmitted from animals to man by means of infected milk. In connection with this subject he desired to call attention to the following occurrence: While convalescing from sickness recently, he had ordered broiled chicken. While preparing it for cooking his wife noticed peculiar spots on the liver and spleen and showed them to him. As they were apparently tubercular, he placed them in preservative fluid until his recovery, when, upon chemical treatment and microscopical examination, the material was found to be crowded with true tubercular *bacilli*. The liver and spleen were especially infected, but *bacilli* were also plentifully found in the mesenteric glands, the lungs and other parts. He had thereupon made inquiries among the cooks of the several large hotels and boarding-houses, and was by them supplied with material for further investigation. In the

short time that he had been studying the matter he had already found six chickens, all very badly infested with the *bacillus* in question, and he believed that probably 5 per cent of all the fowls offered for sale in this city were similarly affected. It was true that most of the organs thus affected were not used for food, yet, this was not always the case. Danger to the human race of infection from this source was greatly reduced, from the fact that the thermal death-point of the *bacillus tuberculosis* was about 150° Fahrenheit, so that in the process of cooking thoroughly they would be destroyed. A much higher temperature, however, is required to kill the spores of these *bacilli*, and, as there could scarcely be a doubt of the existence of spore-bearing *bacilli* in the chicken, it could not be said that danger from this source did not exist. While, therefore, by no means wishing to assume the role of the alarmist, the speaker wished to commend the subject to microscopists and the medical fraternity, for its interest as well as its importance. Specimens of infected organs of chickens were shown, and mounted slides, showing the tuberculous matter and the *bacilli* themselves, all stained by chemical re-agents, were shown under a number of microscopes. A set of slides illustrative of the subject was donated to the Society by Dr. Stallard, and a vote of thanks was thereupon tendered him for his donation and his interesting address.

Two interesting slides of native wire copper from Lake Superior were handed in by Dr. Selfridge.

As an instance of the brilliance with which many animal integuments are displayed by the use of polarized light, the Secretary exhibited a carbolic-acid mount of the human flea, and also a slide of a rare marine crustacean from the Channel Islands.

March 23rd.—The committee to which was referred the subject of tuberculous milk, asked to be discharged, as from the great difficulty of finding suitable material, it was almost impossible to proceed further in the matter at present. In the specimen of cow's lung which had been submitted as containing *bacilli*, none had been detected. On motion the committee's request was granted.

A valuable addition to the Society's already extensive library was made by the receipt of over thirty volumes of publications of the Smithsonian Institution, including all those bearing upon Microscopy. A special vote of thanks was tendered Congressman Morrow for his good offices in procuring this donation.

A very beautiful specimen of crystallized sulphate of baryta, from Derbyshire, England, was received from Thos. Clark, of the

Birmingham Natural Historical Society. It bore a most remarkable resemblance to a transverse section of a vegetable stem.

Mr. Howard showed specimens of *Noctiluca miliaris*, the interesting little organisms to which is mainly due the well-known phosphorescence of the ocean. The gathering (which was a very plentiful one) also contained numerous specimens of the rare *Leptodiscus medusoides* (Hertwig), an organism allied to *Noctiluca*, but distinguished from the latter principally by the entire absence of any transversely-striated tentacle, and by the very regular reticulate appearance of the contained protoplasm.

A block of diatomaceous earth, sent by R. E. Wood, of St. Helena, for examination, was referred to Mr. Howard.

A slide of arborescent silver-crystal was handed in by Dr. E. S. Clark. A slide of native gold-crystals from quartz, also mounted by him, was of unusual beauty.

Reference was made to the newly-discovered deposit of fossil diatoms at Oamaru, New Zealand, which is attracting much attention at present in microscopical societies by reason of its great richness and the large number of forms entirely new to science found therein. A slide of this beautiful deposit was examined with great interest.

A. H. BRECKENFELD, *Secretary*.

RECEPTION OF THE BROOKLYN MICROSCOPICAL SOCIETY.

THIS society was organized in Brooklyn in 1881, and has from that date pursued an uninterrupted, though quiet, course of prosperity. It is composed of about ninety gentlemen, including scientists, physicians and amateurs, and numbers among its members names well known in scientific circles, both in this country and abroad. Its aim has been the informal interchange of ideas at bi-monthly meetings, rather than the delivery of papers, and in this method its record is as unique as it has been useful.

The reception held on Tuesday evening, April 19, was a success, not only in the number of microscopes and general character of objects exhibited, but in the exhibition of original devices and evidences of patient and honest investigation. The tables bearing numbers corresponding with the programme were arranged in three rows in the main hall of the Adelphi Academy, on which were placed some sixty-eight microscopes with their various methods of illumination. One thousand cards of admission were issued, each

one admitting bearer and friends, and, judging from the number present, a very large proportion of them were used.

Space forbids the detailed description of exhibits which their merit entitles them to, but we cannot refrain from noticing a few of the most prominent. Mr. H. B. Baldwin exhibited butter-crystals by polarized light. Dr. E. S. Day, a finely-injected retina of rat; Dr. J. H. Hunt, two sections of human scalp cut vertically and transversely; T. B. Briggs, Esq., a section of syenite from the obelisk; Mr. H. S. Woodman, the multiple image of the second-hand of a watch in a beetle's eye, the perfect management of the illumination and the clearness of the image in this exhibit deserve special mention. A section of pearl by Mr. H. W. Calef was very much admired. Dr. S. E. Steles exhibited a section of skin showing sweat ducts, which elicited much admiration. A section of luxulyanite by J. W. Freckelton would have been a revelation to some mineral section grinders. Mr. C. J. Lawler showed the lanceolated hairs of Dermestes, with a Bausch & Lomb half-inch, which provoked as much admiration for the perfect definition of the objective as for the beautifully-mounted specimen. This exhibit was mounted on one of the Bausch & Lomb Optical Company's inverted chemical stands, and it was remarked by an elderly member that this was the first time he had seen a microscope turned upside down to look around a corner. Mr. Joseph Ketchum exhibited a slide of arranged polycestina by upper illumination, on a Beck international binocular, with a Bausch & Lomb one inch of 45°; a slide of lozenge-shaped crystals of asparagin with polarized light on a Bausch & Lomb professional stand, and one-half inch of the same make of 61°; a finely stained and injected section of the intestine of cat on a Bausch & Lomb Harvard and specimens of *cholera bacilli* on a Bausch & Lomb model stand with a one-sixth dry objective of 140° of the same make. The illumination of this group of instruments was by a novel and convenient form of lime light. It was in shape somewhat like a student lamp, the reservoir containing alcohol which was supplied to the burner in a fine jet when it was vaporized by a jet of oxygen and projected against a small lime pencil. The light was screened from the observer's eyes by a sheet-iron shade in place of the usual porcelain one, and the oxygen was supplied from a small cylinder twelve by three inches in size. The whole equipment was convenient, simple and satisfactory.

Mr. Henry E. Fink, of the Bausch & Lomb Company, exhibited the eleventh commandment in the eye of a needle on their

concentric stand; copper-and-magnesia-sulphate by polarized light, taken from an incandescent lamp lighted by a Gibson storage battery; a fine specimen of the head of a dragon-fly on a universal stand, and a section of black marble on a model stand with a paraboloid illumination.

The exhibit of Dr. A. J. Watts was particularly admired, being prismatic gold-crystals on a Beck binocular with upper light, and fern-gold on a Beck monocular. Plant hairs of *Shepherdia canadensis* was exhibited by Mr. E. C. Chapman, on a stand entirely constructed by himself and which bore testimony to his skill.

Mr. Geo. M. Hopkins' exhibit was a center of a throng of interested spectators. The path of the electric spark on blackened glass occupied one stage; the beautiful phenomenon of Newton's rings, another, while the third bore a slide of salicin-disks rotating in opposite directions, by means of a mica shield covering one-half the field.

Prof. W. C. Peckham's exhibit occupied a table by itself and was well worth the wait necessary to get within seeing distance of his objects. On the first microscope was a specimen of the cariniferous plant hairs of sun dew (*Drosera filifolia*) with paraboloid illumination. No. 2 was occupied by a drop of Ridgewood (city) water, and judging from the remarks of the uninitiated this was the only disappointment of the evening, the ladies particularly approaching the stand with a *don't-let-them-get-loose* look upon their fair features, and surprise was mingled with satisfaction when they discovered that the tigers and hyenas which they expected to see did not exist. On the professor's fourth table was a splendidly illuminated specimen of raphides in *Allium sativum* (garlic).

Mr. H. L. Brevoort showed a fine section of *Cornus florida* (flowering dog-wood) by polarized light. On this stand the polarized prism was rotated by an ingeniously contrived clock-work tram.

Mr. G. E. Ashman had a specimen of insect imprisoned in gum copal (fossil) from Zanzibar, which attracted much attention.

Bacteria termo was well shown by Dr. C. N. Hoagland under a Zeiss $\frac{1}{18}$ oil immersion objective.

Mr. G. D. Hiscock displayed a finely-arranged slide of diatoms by Prof. C. H. Kane, of Camden, N. J., and the head of a diamond-beetle.

Mr. John Green, now with Prof. A. K. Eaton, but formerly with Robert Tolls, exhibited A. Pellucida with a $\frac{1}{12}$ homogeneous immersion of 1.40 N. A., and notwithstanding the constant vibration

of the floor by the multitude present the resolution was perfect even to the laymen present who had never seen it before.

But enough of this. The entire space at your disposal would not suffice to do justice to the subject. At 9:30 the first part of the programme was announced as finished, and in a short space of time lamps were extinguished and tables moved back, and the audience were treated to a stereopticon exhibition of microscopic objects with the magnificent lantern apparatus owned by the Adelphi Academy. Profs. Peckham and Mr. G. M. Hopkins, assisted by students of the senior class of the Academy, projected slide after slide upon the screen, until another hour had passed, and an end came to what was undoubtedly one of the most successful microscopical exhibitions ever held in this State.

The Committee of Arrangements having the matter in charge certainly earned the congratulations of all who witnessed the exhibition. They were: Mr. G. D. Hiscock, Prof. W. C. Peckham, Mr. G. E. Ashby, Mr. Joseph Ketchum and Mr. E. C. Chapman.

MIKE O'GRAPHIA.

AMERICAN POSTAL MICROSCOPICAL CLUB; BOX Y.

No. 1. Samuel Lockwood, Ph. D., from a photograph donated by S. N. Ayres, of Jamestown, N. Y.

No. 2. Micro-photograph of Robert B. Tolles, the eminent objective maker, who died in Boston, Nov. 17, 1883, from a photograph kindly loaned by Dr. George E. Fell, of Buffalo, N. Y., which is believed to be the best one in existence.

No. 3. A micro-photograph of Charles A. Spencer, eminent objective maker, deceased, of Geneva, N. Y., from a photograph kindly loaned by Mr. E. H. Griffith.

Nos. 4, 5 and 6 were miscellaneous objects of interest to the casual observer.

A MEETING of Brooklyn physicians interested in microscopy was held at the house of Dr. Herbert Fearn, 196 Clermont Ave., on Wednesday evening, February 16, for the purpose of organizing as the Medical Microscopical Society, of the City of Brooklyn. The specific object of this society will be the consideration of medical microscopy. Meetings will be held on the first Wednesday evening of each month. The following officers were elected: William H. Bates, M. D., President; Arnold Stubb, M. D., Vice President; Frank M. Hoyt, M. D., Secretary; Henry D. Bliss, M. D., Corresponding Secretary; Albert Brinkman, M. D., Treasurer.

ELEMENTARY DEPARTMENT.

THIRD LESSON.

“CLEANLINESS IS AKIN TO GODLINESS.”

SCRAPING.—In the last lesson we mentioned the valuable aids to be obtained from teasing, not the least of which was the separation of the various elements composing a tissue, thus facilitating examination. In this lesson we shall discuss another method which will serve oftentimes better than teasing for the isolation of the special cells of many organs. This is by scraping. By this method the connective tissues which form a large part of every animal structure, are, in a great measure, left behind, and only the cells held in their meshes and special to the organ, are removed. The process is very simple and can be described with few words.

In the case of the more solid organs like the spleen, liver and kidney, cut into their substance, and then, with a dull blade and from the freshly-cut surface, gently scrape off a little of the tissue. Of this scraping take a portion, the size of a pin's head, tease out in the normal salt solution and examine under cover. Tumors and other pathological growths can be treated as above described.

The method is best adapted, however, for the studying of mucous surfaces and of the epithelium which covers them. Scrape the cleansed surfaces of the skin, tongue, œsophagus, intestines, bladder, etc., and examine small portions in the salt solution.

The beginner may find some difficulty at first in that the prepared specimen will be filled with cells and debris and consequently too opaque for satisfactory study. This state of things can never arise, however, if the specimen is *thoroughly* diluted with the salt solution. We suggested above that a portion of material the size of a pin's head be used. Even this will often be too much. Most satisfactory results will generally be obtained if the portion to be examined be no larger than is easily visible, and this to be separated out in three or four drops of solution. In a well-prepared specimen the cells will be seen in a state of perfect isolation, and can be examined to good advantage.

This scraping method is best employed with fresh material, but will do good service in specimens which have undergone partial hardening in Muller's fluid or alcohol.

It is hoped that the beginner will patiently mount and carefully examine scrapings from the various organs and mucous surfaces. If a live frog be obtainable, very pretty examples of active

ciliated cells can be prepared by scraping the roof of its mouth and mounting immediately in salt solution. If the slide be warmed slightly the cilia will vibrate more actively and for a longer time.

SIMPLE EXAMINATION OF FLUIDS.—These examinations will be found extremely simple if the directions already given in this lesson be remembered. The most important of these is that the layer be as thin as possible, and, if the fluid to be examined be unusually rich in cellular elements, sufficiently diluted.

BLOOD.—Have ready a clean slide and cover-glass. Cleanse the finger and from it draw a drop of blood by puncturing with a sharp needle. Now take up the cover-glass and lightly touch the center with the blood. Invert and slowly lower on the slide. By this means the blood will be spread out in a very thin layer over the surface and can then be examined. The red corpuscles will be seen separate and in *rouleaux*, and the less numerous leucocytes, larger and glistening, dotting the more open spaces in the field. A specimen prepared as above will not last long, as it dries quickly. A more enduring specimen can be made by mixing several drops of blood with salt-solution, to thin and give it volume. Such will last for an hour. Compare the human blood with that of other animals, notably of the frog. The red cells of the batrachian are very large, and as they do not, like human blood, form in *rouleaux* or thick masses, make beautiful objects for study. The nuclei can be developed by adding a drop of dilute acetic acid to the mixture.

Other fluids, pathological or normal, can and should be studied.

EDITORIAL.

THE A. S. M. MEETING FOR 1887.

The committee appointed by the A. S. M. at Chautauqua to select a meeting place for the Society's 1887 session, has finally ballotted in favor of Pittsburg, Pa., a choice which will be welcomed by nearly all, if not all members, in good and regular standing. Of the three other cities extending invitations to the Society for this year, this may be said: San Francisco is too far away; Washington, which we advocated in December, has great attractions, but perhaps would have been an unfortunate selection on account of the International Medical Congress, which meets in September, drawing attention and enthusiasm from the Microscopical meetings; and Indianapolis, the birth-place of the society, certainly deserves to share in the decennial birthday frolic of its

illustrious, and, in many respects, wonderful progeny, which occurs next year. The local microscopical society of Pittsburg is one of the most active and thriving organizations of the kind in the country, and the warm invitation given the A. S. M. will certainly be followed by a still warmer and most gracious reception, so that even at this date, we have no hesitation in prophesying that the coming meeting will be one of the most enjoyable and successful yet held. It might be objected by some that the meeting of last year having been held in the East, the coming gathering should be in this direction. To this may be answered that more meetings have been held West than East, and especially is the place well chosen, on account of the congress referred to, which every medical member of the A. S. M. will desire to attend, in connection with the microscopical meetings. The growing importance of our society is, we believe, recognized by all; but, although much has already been done, there remains more to be accomplished. We hope, therefore, that every member will so arrange his or her summer vacation as to take in Pittsburg August 30, when the meeting will be held. We trust, too, that every worker with the microscope will come prepared to make the meeting a success, and, by paper, work or exhibit, add what they can to the general interest, and to the advancement of the A. S. M. PITTSBURG, AUGUST 30, 1887.

WE should be very glad if the readers of THE MICROSCOPE would send us practical points in regard to the treatment of microscopical objects. Short, concise notes on preparing, preserving, hardening, embedding, cutting, staining and mounting objects—new instruments and methods of work are always acceptable. Five lines on practical work are often of more help to the worker and amateur than pages of description. As we have all stages in microscopical development represented among our readers, from the expert to the dilettante and tyro, we desire to furnish matter of interest to both, and both will always find in our pages something which will be of service in his or her particular stage of development. Let every reader of these lines adopt the motto of the Prince of Wales, "Ich dien," (I serve) and endeavor, by sending us notes or articles which may be of help to others, to assist in disseminating the science of which this magazine is an exponent. There is altogether too much selfishness in this world, and many a man lives and dies with his knowledge hidden in his own brain, of use to himself perhaps, for a time, but of no benefit to the world. Let this be said of no microscopist. Certainly the wonder-

ful instrument by whose power the hidden things of nature are revealed should give to us a broadness of mind and character, and a charity toward all men, so that when our little light has flickered out it may be said of us that we lived not in vain, and, that noblest monument of all, our works do follow us. Lend a hand.

In the death of Dr. A. Y. Moore, THE MICROSCOPE loses a true, faithful and generous friend. Always ready with kindly words of encouragement and suggestion; always willing and prompt with his promised communications, he endeared himself, not only to those of us who could personally call him friend, but to the others who knew him only through his correspondence.

Although so young, he had accomplished much in scientific microscopy. Had he lived he would undoubtedly have distinguished himself greatly in the department of his profession which he had chosen for his life's work. Few men at twenty-seven can boast of so illustrious a career, and few die so universally loved and mourned. Almost from the beginning of this journal Dr. Moore has contributed to its pages, and when disease laid siege at his life's portal, he was at work upon an article for us. The following brief list of his more notable papers published in THE MICROSCOPE indicate his wide and thorough knowledge of microscopy in all its departments:

"The Differential Staining of Nucleated Blood Corpuscles."

"The Podura Scale."

"Amphipleura Pellucida by Central Light."

"The Measurement of Numerical Aperture."

"The Parabola as an Illuminator for Homogeneous Immersion Objectives."

"Beck's Vertical Illuminator and Immersion Objectives."

"The Fakir's Secret."

"Homogeneous Immersion Objectives."

"The Microspectroscope."

"The Zeiss $\frac{1}{18}$ Objective."

"The Detection of Renal Casts."

"A Central Light Objective."

"Mounting Whole Insects," etc., etc.

SECRETARIES of societies will confer a favor by sending us complete lists of their membership. We shall also be glad to have the names of any of the friends of this journal who are not already on our books.

WE are glad to notice that Dr. Alfred C. Stokes' admirable paper, "Observations on *Chætonotus*," which appeared in *THE MICROSCOPE* for January and February is receiving the attention it deserves, both in this country and abroad. Many short notices of the article have appeared in foreign scientific publications, and Dr. Pelletan has published a translation of the entire paper for January and February, including the plates, in his *Journal de Micrographie*.

ACKNOWLEDGEMENTS.—W. H. Curtis, Haverhill, Mass., fine slides of diatoms on algæ; from Prof. S. H. Gage, Cornell University, slide of areolar tissue from cat's arm; from Dr. Thomas Taylor, Washington, slides of butter and fat crystals, photographs and engravings of fat crystals; from Parke, Davis & Co., an admirable portrait of Dr. Robert Koch, of Berlin, the discoverer of the tubercle and the comma bacillus. A copy of this picture will be sent to all professional readers of *THE MICROSCOPE* upon application.

Captain F. C. Grugan, of Fort Barrancas, Fla., has our thanks for courtesies received.

TECHNOLOGY.

PREPARING SECTIONS OF STEM AND ROOT.—In his investigation of the origin of lateral roots in Dicotyledons, (*Ann. Sci. Nat.* Pt. III., 1886), M. A. Lemaire found that sections simply hardened in alcohol were not available, owing to the contraction of the protoplasm: The same objection applies to the use of calcium chloride, the presence of tannin is also a serious obstacle to their examination. M. Lemaire finds that the following process produces good results. The section is first placed in the solution of sodium hypochloride known as Eau de Labarague, until the coloring matters are destroyed and the nucleus and protoplasm dissolved, the cell-walls being left intact. This requires a submersion of from 15 to 20 minutes, but one to two hours produces no bad effect. The best staining material is thin anilin-brown, which he uses as a solution of $\frac{3}{4}$ per cent. in absolute alcohol, then place in oil of cloves until they attain the desired transparency, and finally mount in Canada balsam. Sections prepared in this way are remarkably clear, and may be preserved for a long time. Mounting in glycerin does not answer so well. The process will apply to the study of all meristematic tissues.—*Journal R. M. Society*.

METHODS OF PREPARING CARTILAGE.—Cartilage must be prepared in several ways, as no one preparation can show all the points of interest to be seen. The piece must first be placed in a saturated solution of picric acid for 48 hours. Hyaline cartilage may be taken from the tracheae, the cartilage of the rib (costal) or from the end of one of the long bones before ossification has taken place. Yellow fibre cartilage may be obtained from the epiglottis of an ox, and should be immediately washed and placed in a saturated solution of picric acid for 48 hours, then washed, either cut and mounted or placed in 95 per cent. alcohol for future use. White fibro-cartilage is best obtained from cutting away the intervertebral disc with the bone and placed together in equal parts of chromic and nitric acid until a needle can be thrust through the bone, then wash away all the acid and place in spirit until required. Hyaline cartilage stained in logwood shows the matrix and cells. Costal cartilage from a kitten stained in osmic acid 1 per cent. for 12 hours. This stains the corpuscles a deeper yellow than the matrix. Osmic acid, iodine solution, silver-nitrate solution, carmine and eosin are all required in the staining and elaborate study of cartilage. When the cartilage is of adult tissue it should first be decalcified.—*Amer. Postal-Micro. Club.*

MOUNTING DIATOMS WITHOUT HEAT.—Mr. K. M. Cunningham, of Mobile, Ala., sends the following method: In mounting diatoms a minute drop of the containing fluid is placed on a cover and allowed to dry in the air, protected from dust. This prevents the unsightly matting which occurs when heat is employed. When the cover preparation is thoroughly dry, a very fluid drop of chloroform balsam is placed on it. This in turn is allowed to dry, and the cover then placed on a minute drop of the balsam on the slide. We have tried this method and cordially recommend it, when time is no object.

FINISHING VARNISHES FOR WHITE AND COLORED RINGS.—Mr. C. Wellington, of Jackson, Mich., prepares excellent varnishes, the formulæ for which, although well-known, will bear repeating. These are made by triturating the various colors with the vehicle in a mortar. It will be found best, after preparing each color, to place them in saucers such as are used by artists; the benzole then evaporates, and the color can be taken up in a brush as required, by simple moistening it with benzole. The vehicle: gum dammar, 3 oz.; gum mastic, 1 oz.; benzole, 6 oz. The colors: White, oxide of zinc; blue, ultramarine; red, carmine; black, lamp-black; green, verdigris; yellow, chrome-yellow; gold, gold-bronze.

KAISER'S GLYCERINE JELLY FOR PLANT SECTIONS.—Prof. D. S. Kellicott (Am. Post. Mic. Soc. Note Books) finds that objects, such as stained leaf sections, are best shown in Kaiser's glycerine jelly, to which a large per cent. of gelatin has been added. Kaiser's formula as given by Belerens is: Finest French gelatin, 1 part, by weight; soak 2 hours in 6 parts, by weight, of distilled water. To this add 7 parts of chemically pure glycerine, and to each 100 grams of the mixture add 1 gram of carbolic acid. The mixture should then be warmed with constant stirring for ten or fifteen minutes, till all the flakes which were formed by stirring in the carbolic acid have disappeared. Finally filter while still warm, through glass wool, which has been previously washed and put in the funnel while still moist. As to the method of using this preparation Belerens says: "Glycerine jelly stiffens perfectly at ordinary temperature, and so must be warmed each time it is used. For this purpose it should be kept in a thin-walled test-tube, so that it may be warmed in a moment. Then a drop is taken up by means of a glass rod and put on the slide, the slide itself being gently warmed, and the object which has been previously immersed in a weak solution of glycerine is embedded in it. Then the cover-glass (warmed) is put on and the whole left to cool. The preparation is completed when it afterwards has been provided with a ring of varnish or cement around the edge of the cover-glass.

NEWS AND NOTES.

MR. T. CHARTERS WHITE recently read a paper before the Royal Microscopical Society on "Tartar from Teeth of the Stone Age," numerous preparations being exhibited in illustration.

FROM *Science's* London letter, we learn that the *Zoölogical Record*, which was gradually going the way of all journals lacking support, is to have a new lease of life under protection of the Zoölogical Society. Prof. T. J. Bell will continue as editor.

A WRITER in the *English Mechanic* says that "a brewer without a microscope is almost analogous to a peacock without a tail."

THE assistants of Pasteur are starting at present a new periodical, a monthly paper devoted to all questions concerned with micro-biology, which will contain original contributions and reviews. It is edited by Prof. Duclaux, with the aid of the prominent micro-biologists of Paris. The first number was issued at the end of January. It will contain, also, monthly statistics concerning anti-rabic inoculations.

THE University of Kansas has dedicated Snow Hall for the use of the natural history department.

S. BRODEUX, of Paris, has gone to Montreal to establish a permanent home and introduce in America the methods by which Pasteur cures or prevents hydrophobia.—*Medical and Surgical Gazette*.

The Western Microscopical Club, of London, Eng., recently met at the house of Frank Crisp, Esq., the distinguished Secretary of the Royal Microscopical Society. The vast collection of antique and modern microscopes were exhibited by the host, who gave a most interesting talk, descriptive of the instruments.

Dr. H. G. Beyer, U. S. N., has been verifying and studying the researches of Hueppe and Lister on the microbe of lactic acid fermentation, which he thinks has to do with the souring of milk; while Lauvent, of Belgium, has been studying the microbe of bread fermentation, called bacillus panificus.—*Bot. Gazette*.

THE German *Gesellschaft für Anthropologie* has appointed a hair commission, for the study of hair in its anthropological relations. The examination of hair for this purpose involves considerable labor, but it is important work which may be carried on by any microscopist who will take the trouble to collect the hair of different races of men. The particular features to be considered, macroscopic and microscopic, are given in the society's publication—*Am. Mo. Micro. Jour.*

PROF. T. B. STOWELL, of Cortland, N. Y., has recently purchased a palæontological collection of over 10,000 specimens. The collection is valued at \$3,500, and is one of the most complete of its kind in the country. This, with Prof. Stowell's prior collection, makes one of the largest private collections of its kind.

A FACT too little recognized by the journals of microscopy generally, is that microscopy is an adjunct to scientific research, and not strictly a science in itself—a means and not an end. Too much space is given to beautiful objects, the ways of making beautiful mounts, and generally to the pleasant ways of whiling away time with a microscope, and too little to the serious use of the instrument as a means of research in mineralogy, vegetable and animal histology and various other departments of science.—*Pacific Record, med. and phar.*

Ellenberger has found that a great part of the sugar formed from oats in the stomach of horses is due to the action of bacteria contained in the food. Neither the saliva nor the gastric juice can account for the quick formation of sugar from starch to such an extent.—*Western Druggist*.

DR. TSCHIRCH recommends the addition of lead or barium compounds to the alcohol used in preserving plants as an efficient method of retaining the original colors.—*Botan. Gazette*.

MR. H. N. RIDLEY, assistant to the British Museum, is going to visit Fernando Noronha, the beautiful island off the Brazilian coast. The Brazilian government has granted him permission to make botanical and zoölogical collections on the island, though generally visits of strangers are prohibited on account of a colony of convicts being established there.—*Science*.

THE *Medical News* says that corks may be rendered perfectly ether-tight by coating them with a solution consisting of four parts gelatin, fifty-two parts boiling water, and one part ammonium bichromate, which should be added to the filtered gelatin solution. After coating, expose the cork for several days of sunlight.

DR. BESSEY calls attention to the fact that the roughness of certain uredospores can only be seen when mounted dry. His attention was called to the fact by a student's difficulty in seeing the prickly wall of the uredospores of *Puccinia coronata* when mounted in water. When mounted dry the prickles appeared with great distinctness.—*Bot. Gazette*.

By mixing acetate of lead and iodide of potassium on a slide, interesting and beautiful crystals may be observed growing under the microscope.

The colonies of Australia and the neighboring islands have some twenty scientific societies, with a membership of between 2,500 and 3,000. These organizations are to meet in 1888 for the purpose of forming an Australian association for the advancement of science, similar to the important associations now existing in England, France and the United States.—*Swiss Cross*.

THE outer coat of the bulb of *Gladiolus* contains some good examples of *long crystal* prisms; these show well with the polariscope. Leaves of *Lemna trisulca* contain true *raphides*; some are found in cells, and some in intercellular spaces. Large intercellular spaces, containing air, may be seen in the centre of these leaves which enables the leaves to float on the top of the water.—*Journal of Microscopy*.

THE publisher of *Science* has a new journal, *Science and Education*, which will contain the best papers from *Science*, and others original. This new periodical will prove of great service to advanced teachers, containing, as it will, the latest scientific and educational news of the day.

BOOK REVIEWS.

MICROSCOPY FOR BEGINNERS; or Common Objects from the Ponds and Ditches, by Alfred C. Stokes, M. D. Illustrated. New York: Harper & Bros., 1887. Detroit: John Macfarlane. p.p. 308.

We have often wondered why so little attention has been paid by writers of books for beginners to the microscopic life to be found in every stagnant pool and pond, objects so easy of access, so wonderful in structure and beauty, so remunerative in pleasure-giving and profit to the observer. For the examination of these there is required no tedious process of embedding, no microtome making infinitesimally thin slices, no stains or staining—the simplest accessories and a moderately high-power objective are all that are necessary for their study. In the volume before us we have the ideal book for beginners in the investigation of aquatic life, a hand-book that cannot fail to render great service and accomplish much good. In the first chapter the author gives some excellent advice in regard to microscopes, oculars and objectives, with directions for the manufacture of the needful accessories, and a list of publications helpful to the student. The second chapter is devoted to the description of the commoner aquatic plants, and—best of all—the microscopic, animate creation which may be found clinging to their leaves and stems is mentioned, with references to the succeeding chapters in which they are described. The following chapters are devoted to such objects as desmids, diatoms, fresh-water algæ, rhizopods, infusoria, hydra, aquatic worms, rotifers, polyzoa, etc., etc., nearly all of which are well illustrated. The language of the book is withal so simple and explicit that the merest tyro cannot fail to comprehend and appreciate the subjects treated. We hail “Microscopy for Beginners” as the fulfillment of a long-felt want, and believe that all amateurs in this branch of research will feel equally grateful for and delighted with Dr. Stoke’s latest work.

COLLINS CATALOGUE, No. 16.

This catalogue is filled with the titles of rare and interesting books on microscopy and natural history for sale by Mr. Collins.

NOTES ON MICROSCOPIC METHODS, by Simon H. Gage, Cornell University.

It is to be deplored that this little work was gotten up only for the use of students in the laboratory of the Anatomical Department of the University, for it possesses so many excellent aids and ingenious devices to encourage and lead on the beginner that it certainly deserves a wider circulation. None but a careful teacher could have devised a guide so filled with just those practical points on which all students need information, nor could another have arranged them in a more convenient form. We hope to see the little work before the public at no late day.

THE PHYSICIAN'S LEISURE LIBRARY, Geo. S. Davis, Detroit.

Dr. Paul F. Mundè contributes the latest addition to this valuable series, his subject being, "Pregnancy, Parturition and the Puerperal State, and Their Complications." The name of the author is sufficient guarantee of the excellence of the book, which is an epitome of valuable points for the busy practitioner who has little time for consulting the larger works. The diagnostic methods and treatment advocated are the latest.

PNEUMATIC DIFFERENTIATION. Ten reprints, by Joseph Ketchum and others.

SPECIALISM IN MEDICINE, by Ross R. Bunting, M. D. Reprint.

PRACTICAL OBSERVATIONS ON THE GONOCOCCUS AND ROUX'S METHOD OF CONFIRMING ITS IDENTITY, by Charles W. Allen, M. D. Reprint.

AMERICAN PUBLIC HEALTH ASSOCIATION: PRELIMINARY ANNOUNCEMENT FOR 1887.

REMARKS ON LOCAL CAUSES OF WATER CONTAMINATION, by R. H. Ward, M. D. Reprint.

A REVISION OF THE NORTH AMERICAN SPECIES OF FISSIDENS, by Charles W. Barnes. Reprint.

NINTH ANNUAL REPORT OF THE PRESBYTERIAN EYE, EAR AND THROAT CHARITY HOSPITAL. Baltimore, 1886.

THE NEW TREATMENT OF CATARACT PATIENTS, by Julian J. Chrisholm, M. D. Reprint.

CORRESPONDENCE AND QUERIES.

Editors of THE MICROSCOPE:—

As the method of securing and chloroforming a cat, given in your last number, differs very much from the one which I have found to be successful, I submit the latter to your readers.

Such cats as I have operated on, would, I think, put in some very sharp objections to being tied down. I fear that I would have use for a large supply of court plaster if I were to try the tying.

Our specimens will be of much greater interest if we inject

the animal, and as it is but little more trouble, we will give the method. Although only about one-thirteenth of the weight of an animal is of blood, we will need a much greater proportion of injecting fluid, because the arteries must be well distended with the gelatine in order to fill the capillaries. I prefer a cat not more than about one-third or one-half full size, because the specimens from such make nicer microscopical slides, than larger ones do.

For a full sized cat I place two ounces of Seiler's injecting gelatine into a wide-mouthed bottle with twenty ounces of cold water. After soaking ten hours or more the gelatine will be soft, but the pieces will retain their form until heated. The bottle is next placed in a dish of hot water, and after the gelatine has dissolved it should be strained through a cloth, placed in a bowl and be kept warm.

We will now try the injecting syringe with warm water, to make sure that it works well.

Next see that we have at hand a box large enough to easily admit the cat, also have a bottle of chloroform, a piece of cloth or a small sponge, a couple of surgeon's curved needles threaded with cotton or linen, (silk sticks to the wet hands, making it more difficult to handle) a sharp pocket or other sharp-pointed knife, a pair of scissors, a large wash basin with warm water, a pail of cold, or better, ice water, and a kettle of hot water.

We will now take up our cat, fondle it a little to prevent fright, then lay it into the box and close the lid and place our foot on it, next saturate the sponge or piece of cloth with chloroform, raise the lid sufficiently to admit the anesthetic and slip it in. It is likely that a paw will be protruded, but pressure on the lid will cause the retraction of the foot.

We can now sit or stand on the box until we feel no more signs of movement from within. When the animal is well under the chloroform, but not dead, we will remove it from the box, and, commencing below the umbilicus, open the abdomen, run two fingers over the intestines as guides, we cut between the fingers, from within outward until we reach the neck.

With the scissors we will cut away a portion of the ribs and adhering muscle which are in the way of conveniently working at the heart. Now we will cut off about one half-inch of the apex of the heart, which will open the left ventricle only.

To drain the blood from the animal, we will hold it up alternately by the ears and tail, then place it in a basin of warm water.

Now pass the detached nozzle of the injecting syringe up through the open ventricle until its end is about one quarter of an

inch into the aorta ; if, as is usually the case, the aorta be hidden by adipose tissue, do not cut, but shove the fat aside, and do not forget that passing the nozzle too far up will put it through the arch of the aorta and spoil the job. Having the nozzle in place we will pass the curved needle around the aorta, being careful not to wound the aorta, nor to pass the needle so deeply as to include the superior vena cava. Using a surgeon's knot tie the aorta tightly to the syringe nozzle, then bring the ends of the thread up over the hook at the base of the nozzle and tie it there also to prevent the nozzle from slipping out, then place the animal in the warm water and see that the heart is under the water.

We will now remove the syringe from the warm water and fill it with the warm injecting fluid, place its nose under the water and into the nozzle, giving it a firm twist to secure it. Proceed with the injecting very slowly, taking about a minute to empty the syringe ; you will see the intestinal arteries filling, which will cause a curious vermicular movement of the intestines, the animal will usually kick and go through various motions, although quite dead, while the warm gelatine is filling the system.

Before the syringe is entirely empty, turn the stop cock, remove and refill the syringe ; in replacing the nose into the nozzle, keep the point under water as before, to prevent the entrance of air. When sufficiently injected, the pads of feet, nose, etc., will be of a natural color. I have had the best results when I passed in the gelatine until considerable of it had made the circuit of the animal and escaped into the water. We having satisfied ourselves that sufficient fluid has been forced in, will turn the stop cock, remove the syringe and drop the animal into the ice water, where it should remain with the syringe nozzle in the heart for some hours.

I usually inject the animal in the evening, leave it in the cold water until next morning, when I remove the intestines, cutting them from the stomach, tie the nose of the syringe into the end cut from the stomach, place the intestines into a basin of cold water and inject cold water through them until the water comes out clear.

I secure the brain by severing the head from the body then holding it in the left hand against a bench, with a screw driver held in right hand, commence at the foramen magnum, break away the skull piece by piece by pressing outward, then by careful manipulation cut away the under attachments until the brain drops out. It is best not to divide the brain until it has been in alcohol some hours, after which we will sever the cerebellum from the cerebrum, but will leave the medulla oblongata, attached to the cerebellum.

Continue the longitudinal fissure until the cerebrum is divided into two halves, we will then place the three pieces of brain into alcohol, and by changing the alcohol two or three times, the brain will be hard enough to cut into thin sections in twenty-four hours.

In cutting it is best to cut the sections transversely from the cerebrum.

Lay the cerebellum on its side so that the sections may be cut in the opposite direction to those from the cerebrum, that is, while both are verticle sections, those from the cerebrum run across the head, while those from the cerebellum run in the direction from back forward, and on reaching the medulla oblongata, the sections of cerebellum will adhere to it, showing the medulla as the ground and the cerebellum with arbor vitæ standing on it like a tree. We may secure the spinal cord by laying the animal on its back, and with a chisel cut down close to the sides of spinal column, and continuing the cut the whole length of the vertebra and entirely through the animal to the bench, do the same on the opposite side of the vertebra, remove and lay the slice on its side, next place the chisel on the spine and with a hammer tap on the chisel so as to fracture the vertebra over the spinal cord, continue the tapping until the fracture has been carried the whole length of the column, turn it over and treat the other side in the same way. Then take hold of the two sides one in each hand and pull them apart, the cord will drop out with the stubs of the nerve roots attached.

Müller's fluid does not work well in my hands, I dislike it because it gives a disagreeable tint to the specimens. I place all of the specimens in ordinary alcohol and find that if the specimens are cut into pieces not larger than three-quarter inch cubes, and that if the alcohol be changed a few times, there will be no want of other hardening, unless the cutting is done by Dr. Jas. E. Reeves' method in which case the specimens will need transferring from ordinary to absolute alcohol for a time. We will, on making thin sections for the microscope, cut the ears and other portions of the skin in the direction of the hairs so that in the mount we may see the hair from its tip to root. The tongue should be cut into vertical longitudinal sections so that it may show the hooked papilla in full size, the alternate layers of muscle in the center of the tongue, the subcutaneous band, beautifully blending with the layers at right angles to it, the grand net work of capillaries, striations of the muscles, etc. The transverse sections of intestines furnish not only very beautiful slides but also specimens of great interest to the physician and student of physiology.

R. N. REYNOLDS.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be given ONE INSERTION FREE OF CHARGE. Dealers are referred to our advertising department.

WANTED—Copy of "Hogg on the Microscope," latest edition, for which I will exchange secondhand copy of Beale's "How to Work with the Microscope," in good condition. Address W. T. COX, M. D., Groesbeck, Texas.

FOR SALE—A Tolles 1-10 glycerine im. 180°, a Wenhaus Reflex Illuminator, made by Mr. Tolles to use with the above lens, and a Fasloldt Micrometer, 1-5,000 to 1-120,000, all in fine condition and cheap. Best of reasons given for selling. Address F. J. SCHAUFELBERGER, Hastings, Neb.

DR. JAMES E. REEVES, 2235 Chapline street, Wheeling, W. Va., will dispose of a few of his fine mounts of typhoid bacilli, grown on potato, 30th culture, etc.

WILL EXCHANGE slides of plants, bark, heart and tongue of swine, all double stained, for good histological slides double stained with sulph-indigotate soda and carmine. Satisfaction sure. Correspondence solicited.

J. D. BECK, Box 10, Liberty, Tioga Co., Pa.

WANTED—Injecting syringe, case of dissecting instruments, and a valentine knife; will give fine slides or cash.

HERBERT M. RICHARDS, Sadsburyville P. O., Chester Co., Pa.

I HAVE a very fine case for a microscope, 18 inches high and 8 inches square, inside. Would exchange for a first-class $\frac{1}{4}$ inch objective.

A. W., No. 42 Allen St., Jamestown, N. Y.

FOR SALE—Nacht microscope, manacular, slide carrier on stage, 4 objectives. Nos. 24, 1, 3 and 5, French; 2 eye pieces; bull's eye condenser; 24 objective makes an excellent illuminator; camera lucida; forceps; mahogany silk-lined lock case, slides, etc. Cost 625 fr. Price, net, \$75. Address

C. A. FERNALD, M. D., 1483 Washington St., Boston, Mass.

FOR SALE—A Beck Binocular Economic microscope, in perfect condition, with $1\frac{1}{2}$ inch object glasses, two pairs of eye-pieces, concave and plane mirrors, side condensing lens for illumination of opaque objects, movable glass stage, stage forceps, plies with ledge, in mahogany case, stand $15\frac{1}{2}$ in. high. Has been used about twenty times. A first-class instrument, cost \$95, will take \$80.

WANTED—A two-inch objective, C eye piece and polarizing apparatus, Bausch & Lomb preferred.

E. H. RICHARDS, Woburn, Mass.

WILL EXCHANGE fine mounts of gold, silver, copper or tin, or of crystals for plenicope, for good histological or botanical mounts.

H. M. HILL, 30 William St., Watertown, N. Y.

WANTED—A second-hand polariscope, Bausch & Lomb preferred. Also good slides or material for scientific Americans.

W. C. GORMAN, Waterford, Pa.

WANTED—Who has for sale, cheap, first-class $\frac{1}{2}$ inch objective, and glass stage and slide carrier, for stage $3\frac{1}{2}$ in. diameter, both Bausch & Lomb. Address

F. W. POINDEXTER, Jeffersonville, Ind.

URINARY CRYSTALS in exchange for same, also correspondence with others on unusual products of urine.

J. M. ADAMS, Watertown, N. Y.

WANTED—A Microtome with freezing apparatus, in good working order.

J. H. THOMPSON, 17 26th St., Kansas City, Mo.

EXCHANGE—Tegel (Fossil Deposit) from Brümm, Moravia, Austria containing fine forms and Marine Diatoms. Samples of 50 Grammes will be sent to anyone. Wanted in exchange good American Diatomaceous material of all kinds: Preferred, fossil earth from Santa Monica, Santa Maria, Monterey, Cal., and Seaweeds or Seamud, with Marine Diatoms.

J. C. RIMBOCK, 14 Simmering-Wein, Vienna, Austria.

WANTED—Second-hand Microscope of modern American make, with accessories and objectives, 2 inch to $\frac{1}{2}$ inch focus. Parties having same, in whole or in part, please address

EDWIN A. HILL, 26 W. New York St., Indianapolis, Ind.

TO EXCHANGE—Carpenters, "The Microscope and its Revelations," new, for Beal's "One hundred urinary deposits," and Dolly's "Technology of Bacteria Investigation."

A. R. BOOTH, M. D., Shreveport, La.

100 POUNDS Gulf Marine diatom muds for exchange; 10 selections of cleaned Marine Gulf diatoms. Correspondence invited from anyone.

K. M. CUNNINGHAM, Land Office, M. & O. R. R. Co.

WANTED—Part I (plates and text) of Special Report on the Food, Fishes and Fisheries Industries of the U. S., 1882, devoted to the natural history of useful aquatic animals. Give lowest cash price.

E. S. COUTANT, Hawk's Park, Florida.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,
At 21 State Street, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 25 Washington Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. Box 583, Detroit, Mich.

No receipt will be sent for subscriptions received unless specially requested.

Specimens for examination should be sent to the *Microscope Laboratory*, 25 Washington Avenue, Detroit, Mich. In all cases the transportation charges on these specimens must be prepaid, and special directions for packing and shipping will gladly be sent upon application.

VOL. VII.

DETROIT, JUNE, 1887.

No. 6

ORIGINAL COMMUNICATIONS.

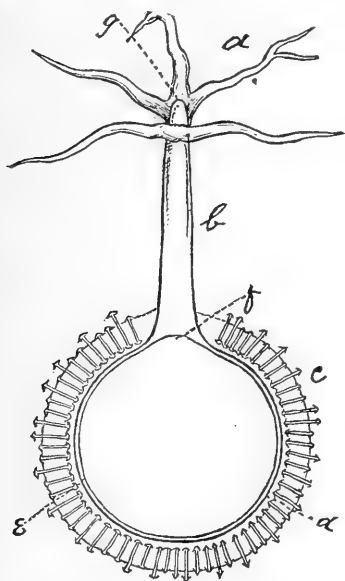
NOTES ON THE GENUS *CARTERIUS*,* FORMERLY *CARTERELLA* OF THE FRESH-WATER SPONGES.

HENRY MILLS.

THE fresh-water sponges in the genus *Carterius* are now known to be distributed over a large portion of this country, and they have also been found in several localities in Europe. Notwithstanding the marked peculiarities which distinguish them from every other genus, they were unknown till seven or eight years ago. The first specimen in the genus, as far as I know, was found by Prof. D. S. Kellicott, of Buffalo, in the Niagara river, who kindly handed me a small portion of it for identification in 1879. At about the same time, Mr. Edward Potts found a sponge in the Fairmount park, Philadelphia, of quite another form, but of the same generic character. In a short time Mr. Potts found a second specimen, still differing from either of the foregoing, but evidently belonging to the same family,—thus making in all, three distinct forms in a few months unlike anything seen before. They were soon identified as so many species, and a new genus was established. At the suggestion of Mr. Potts, this was named after Mr. Carter, of England, who has done more for the advancement of a knowledge of the fresh-water sponges than any other person. Soon after this, I also found large quantities of the first and third species in the Niagara river, and the Scajaquady creek in Buffalo, and also received a good supply of the last named, from Dr. Newcomer, of Indianapolis, which he obtained from the water works of that city.

* The form of appellation for the genus was changed from *Carterella* to *Carterius*, when it was discovered that the former had already been applied to a genus of fossil sponges. This, for the benefit of those who have slides of the early mountings.

There are now four, if not five, species in the genus with some varietal forms not yet determined, none of which were known eight years ago. It should be stated that the peculiarities which distinguish the fresh-water sponges from some of the marine species, is the presence in the former of small, seed-like bodies, visible to the unassisted eye. These are a kind of winter-egg, or resting-spore for the preservation of the species during the changes incident to fresh water in winter. These bodies are now called statoblasts, (*formerly*



Diagrammatic view of statoblast of *Carterius tubisperma* Mills: c, globular body in section, surrounded by birotulate spicula, one end of which rests on the chitinous coat d; b, tube of statoblast, which is a continuation of d; a, cirrus process too hastily drawn; e, delicate placenta-like membrane, holding the germinal cells, which, when mature, and under suitable conditions, are supposed to escape at f, pass up the tube, making their exit at the end g.

gemmae,) in keeping with the name given to bodies of a similar character found in the fresh-water polyzod. The points of distinction between the genus *Carterius* and the sponges of other genera, consist in the presence of certain cirrous appendages, attached in various forms to the foramenina of the statoblasts of the genus, as now to be described.

Carterius tubisperma Mills: has a tubular process extending from the foramen of the statoblast, and varying somewhat in length, but generally as long as one diameter of the globular body. To this tube are appended several tendril-like or cirrous processes, also varying in length, and ending sometimes in a poorly-defined, or rudimentary hook. I have found specimens of this sponge as large as one's hand, and have supplied them to the British and Liverpool

museums, to Austria, and the National museum at Washington, D. C.

Carterius tenosperma Potts, has long tendril-like processes extending from the foramen of the statoblast to nearly six inches in length. These are frequently so knotted, and tangled together, that it is difficult to separate them, their purpose being, one might naturally conclude, to hold the mass of sponge from being scattered by freshets or other causes.

Carterius latitenta Potts, is a sponge of similar character to the two foregoing, but it has wide, almost ribbon-like processes, (some-

times only one,) the termini of which are a rudimentary hook. I have lately found a specimen of what I am disposed to regard as a variety of this species, in which the foramen of the statoblasts terminate in a well-defined cup, with an even, circular margin, without any cirrous appendages. This peculiarity, if found to be constant in several mounted specimens, will be sufficient to constitute it a new species.

The fourth established species of the genus was found in Russia by Prof. P. F. Stephanon, of the University of Kharkow. It was described, and named by Dr. Dybowski, of Novogrodek, *Dosilia Stepanowii*, probably without his knowledge of the genus *Carterius*. The term *Dosilia* has since been dropped, and the proper generic one substituted. It is now *Carterius Stepanowii* Dybowski.

Having seen nothing more of this sponge than a drawing representing one of the statoblasts, I can only describe it so far. It appears to be more like *C. tubisperma* than the other species in the genus, the difference being principally, that the tendril-like appendages proceed from an almost square flange, or collar, placed at the end of the tube, instead of starting immediately from it. The same in a very slight degree has been observed in *C. tubisperma*. I am justified in saying that Mr. Carter regards it identical with *C. tubisperma*.

It is by the form and manner of spiculation in most sponges, that their classification is established; but, in the genus *Carterius*, the foramenal appendages are at present of paramount importance.

While this is being written, intelligence comes across the water that still another specimen or two have been found, this time by Prof. Petr, of the Prague university, the description of which, with beautiful illustrations, was published by him in the Czesch language at Prague, in 1886. Also of another specimen found by him in the same district, and named provisionally, *Ephydatia bohémica*, wherein according to a note of Mr. Carter's in the *Annals, and Magazine of Natural History*, for March, 1887, the statoblasts present an incipient condition of the cirrous development characterizing *Carterius*.

All the appendages of the species that I have seen, are of the color of amber, in this respect resembling the chitinous coat, lining the statoblast. They all take stain well, either of the aniline dyes, or carmine.

Great progress has been made in this interesting branch of natural history in the old world during the past few years. Dr. Dybowski already named, has found *Spongilla lacustris* in seventeen

places, which he names, including specimens found in the south-west of Lake Baikal in Asia. Monographs on the fresh-water sponges have been written by him, and by Dr. Vedjovski, of Prague, Bohemia.

Fresh water sponges may be found in most of our rivers, ponds and lakes, attached to the undersides of submerged logs, and pieces of wood, or stones. Old rafts of logs that have been lying for some time at the mill-dam, yield fine specimens. They are sometimes attached to weeds, *Anacharis canadensis* and *Valisneria spiralis* being their special favorites in some waters. I have found them on the ground where the light has been partly excluded, darkness being generally favorable to their growth. As a rule, according to my experience, they prefer slowly-running, or still water, to swiftly-running streams. In very winding, and swiftly-running streams, the current is comparatively slow at the outer edge of the curve; in such places I have found good specimens. Their appearance under the best conditions, is not unlike the domestic sponge, though at other times they take on various hues of buff, and also of green. In some species the statoblasts are abundant as early as the latter end of June, while other species are not fully supplied with them till October and November. In the earlier summer months, they frequently spread out on the undersides of stones almost like fine net work, becoming thicker as they grow older. They are at all times beautiful and instructive objects under the microscope, and reward the careful student of their peculiarities, equally with any objects of natural history under the same conditions.

NEW MEANS OF HANDLING SECTIONS OF TISSUE FOR THE MICROSCOPE.*

WALTER Y. COWL, M. D.

MR. PRESIDENT.—Since the microtome was first used in the practical pursuit of histology, and in fact ever since we have been able to cut large and thin sections of tissue, a need has been growing for some more delicate means of handling these very fragile objects than the ordinary copper section-lifter and steel needle.

And this need has considerably increased since the perfection of those methods of freezing specimens, whereby comparative homogeneity is attained in the mass and sections of extreme tenacity secured from soft or even fresh tissue.

*A paper read before the New York Society for Medico-Scientific Investigation.

The difficulty of manipulating a section from half to three-quarters of an inch in diameter, which in thickness is no greater than the cells that compose it, need only be mentioned to be apparent. This extreme tenacity is to be obtained of course only with the most perfect preparation for cutting, both of the tissue itself and of the knife and machine; but sections are now frequently cut of a thickness averaging no more than double that of medium-sized cellular elements.

I need hardly state to you that for the successful mounting of such sections when over one-quarter inch in diameter, the needle and copper-lifter necessitate the utmost patience and delicacy of touch on the part of the worker, whilst often even therewith a choice section will be torn or mangled so as to lose half its value as an exemplification of healthy or morbid structure.

Excepting students and others ready to devote a large share of time to microscopical work, it may be said that only those who have labored perserveringly with these tools on really thin machine-cut sections, appreciate the vexation and annoyance attending their use.

These difficulties in the way of satisfactorily mounting such specimens within a reasonable space of time, led me to make an effort to secure some more facile means of manipulating sections than the greasy copper-lifter and the ravaging needle.

Perhaps the weightiest objection to copper or other metal in a section-lifter is its property of rejecting water or glycerine, unless just cleansed with alkali or ether.

When mounting sections containing any fat—in reality a large majority of all sections—the lifter soon becomes coated with a film that causes water or glycerine to rise upon it in globules, which disarrange the section and greatly hinder the worker.

If instead of metal, however, we take some substance which in its natural condition contains moisture, such, for instance, as horn, we at once avoid this difficulty. I therefore present to you a section-lifter made of horn. It is in one flat piece, weighing ten grains, and is three inches long and five-eighths of an inch in width at the blade, which is square, of about $\frac{1}{20}$ of an inch thick and merging into a handle one-twentieth of an inch thick, and three-eighths of an inch wide.

The blade is smooth, flexible as paper and pierced with fine holes. It can thus be easily insinuated beneath a section lying flat on the bottom of a dish, and upon removal from the surrounding fluid will allow it to drain away from between the section and the lifter. This brings the two into uniform apposition, which is the great *desideratum*. The perforations also favor the floating of the

section from the lifter to the mounting or preparatory fluid on the slide.

The instrument is easily held between the thumb and finger, and motions with it may be made of great delicacy, either with the unaided eye, a watchmaker's loup or a preparing microscope.

As horn normally contains grease as well as moisture, it will take oily or gummy media, but must then be confined to use with them.*

In preparing specimens the lifter is preferably inverted over the slide when loaded with a section, whilst a drop of fluid, let fall on the holes in the middle of the blade, loosens the tissue, from which the instrument may then easily, and with gentleness, be withdrawn. As the horn is transparent, every detail of the section on its under-side can be seen.

But the use of such a section-lifter naturally suggests something similarly facile instead of the needle, and this is to be found in a stout bristle.

It may be held in a clamping needle-holder, such as is now sold for microscopical purposes, and when so mounted, or even simply tied to a stick, will so far surpass the needle as a means of manipulation, that no one who has ever tried it will cease its use.

The simplicity of the means, as well as its previous employment as a guide in illustrating anatomy, may ere this have given rise to its use by microscopists for manipulating sections; but of any such adaptation I am unaware. A similar remark can be made with reference to the horn section-lifter.

In conclusion, it may be said that in the mounting of thin sections of over a quarter-inch in diameter, at least four of them can be placed flat upon the slide with the bristle and horn-lifter in the same time as that taken from one where metallic means are used. As with glycerine preparations the time is chiefly spent in placing the sections in position, the saving with this deservedly superior medium is fully one-half.

CRYSTALLIZATION BY COLD—A KINK IN MICRO-CHEMICAL TECHNOLOGY.

FRANK L. JAMES, PH. D., M. D.

IN MAKING micro-chemical examinations it constantly happens that we wish to obtain the crystalline matter from some minute quantity of fluid holding it in solution. When the liquid is comparatively abundant, or say in quantities of a half fluid drachm and

*Lifters for water or glycerine must be made of burnt horn; *i.e.*, deprived mostly of fat.

upwards, the usual laboratory process is to put it into a watch-crystal or small evaporating-dish and hold it over the flame of the lamp or on the bath, applying the heat carefully. As the crystals begin to form, a pointed glass rod is drawn over the surface of the container, making little furrows around which the crystals form.

When the liquid is in lesser quantities,—only a drop, or maybe two or three minims, it is put upon a slide or watch crystal that has previously been heated, and the pointed rod used as before. Should the heat not be sufficient, a second slide is made quite hot and shoved under the first, the process being repeated as often as necessary.

The crystals thus obtained are rarely satisfactory, and very frequently it is possible to obtain nothing more than an amorphous powder, when we know crystallizable matter exists and should be recovered.

Some years ago, while making some experiments requiring the crystallization of very small quantities of fluids, the following plan was suggested to me—whether by something I had read or seen, or whether it came intuitively, I do not now remember, it is so long ago:

Provide two watch-glasses of nearly the same size and shape so that they fit snugly into each other. Into one of these pour the liquid to be crystallized, and having warmed the other by passing it through the flame of the lamp, or dipping it into hot water, place it immediately on top of the globule of fluid, letting it settle to place of its own weight. The fluid is thus spread out into a tenuous film between the two watch-glasses.

Now place the glasses upon a piece of felt, two or three thicknesses of blotting-paper, or some other non-conducting material, and with a pipette pour into the cavity of the upper crystal a half fluid drachm of rhigoline, benzol or ether, and blow on it with the lips. In a moment the rapid volatilization of the liquid will produce a great lowering of the temperature, and the film of liquid between the glasses will commence to deposit its crystals. Sometimes this occurs instantaneously, but generally it requires from 15 seconds to a minute to thoroughly cool the glasses. The application of volatile fluid must be repeated if necessary.

As soon as the deposition of crystals ceases take a bit of blotting, or filter-paper and pass the edge of it between the watch-glasses and absorb the remaining mother liquor, leaving the crystals nearly dry. The upper glass may now be removed, and the lower one, with its crop of crystals, placed directly on the stage of the microscope, or, if necessary, the crystals may be collected and washed before examination.

When put under the lens each crystal will be found to be geometrically perfect—something rarely found under the methods usually obtaining in micro-chemical work. The philosophy of the process is plain and needs no explanation. Of course it is presupposed that the liquid to be crystallized is in a concentrated state. If it is not, it should be made so by careful evaporation down to the point of saturation. With such small quantities this is easily accomplished by placing the containing crystal on a hot slide for a few moments. Where the operation must be repeated it is best to use a clean crystal for each portion, or to carefully remove the crystal resulting from previous refrigerations, since the second crop of crystals will have a tendency to form around and on the first, thus making masses too large for convenient examination with high powers.

The use of the pipette for placing the volatile fluid in the upper watch-glass is recommended because of the difficulty of pouring small quantities of readily flowing liquids with any exactness, and the consequent danger of having it overflow the container and mix with the fluid to be crystallized.

It was by following the method here described that I managed to secure the very uniform and beautiful crystals of hæmatöidin and cystin which I exchanged with microscopists throughout the country (through the medium of THE MICROSCOPE,) a few years ago.

PROCEEDINGS OF SOCIETIES.

THE MICROSCOPICAL SOCIETY OF BALTIMORE.

THE Microscopical Society of Baltimore held its regular monthly meeting at the office of Dr. William B. Canfield, 1010 North Charles street, on Monday, April 18, at 8 P. M., the President, Prof. G. L. Smith, in the chair.

Dr. Canfield showed the Abbé camera-lucida; the freezing-microtome of Ch. Roy; a convenient form of injecting-syringe with spring attachment to hold the nozzle in place while forcing the injecting fluid through the blood-vessels; and by request, he explained and demonstrated the process of embedding in celloidin. He also showed mounted specimens of: 1. Tubercle bacilli (contrast staining). 2. Anthrax bacilli (contrast staining to show the spores). 3. Spirilla of Asiatic cholera (comma bacilli). 4. Taenia heads. 5. Anthracosis, or coal-miner's lung.

Mr. F. W. McAllister spoke of using gasoline instead of ether in the freezing-microtome. He thought the cost of ether would pre-

vent its universal use, and thought gasoline, although more dangerous, was preferable on account of its slight cost.

Dr. Geo. M. Sternberg spoke of the great progress made by the San Francisco Microscopical Society and of their fine library, and hoped our society would emulate their example.

The Society then adjourned, after electing new members, to meet May 16 at 8 p. m.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE regular meeting of this society was held April 13, 1887, President Wickson occupying the chair.

Upon the recommendation of the committee appointed to report on the matter, it was decided that the Chair should hereafter at each meeting appoint two members whose duty it would be to provide and display a number of interesting and attractive microscopic objects at the meeting next ensuing.

As an instance of how a grain of truth may sometimes be transformed into a mountain of error, the Secretary read an item which has been going the rounds of the interior press, and which announced the discovery of a new glass in Sweden, composed principally of boron and phosphorous, of such extraordinary refractive power that lenses made of it would reveal the "one-two-hundred-and-four-million-seven-hundred-thousandth part of an inch!" The basis of this extraordinary paragraph was probably the recent introduction of the new optical glass made at Jena, containing small proportions of borates and phosphates. By the use of this glass it has been made possible to construct lenses with less chromatic aberration than heretofore, but as the refractive index is practically that of ordinary glass the magnifying power for any given curvature is, of course, also about the same.

The exhibition of the new "Doty Balsam-mounting Bottle" brought out a discussion of various late methods in balsam mounting, and of the relative advantages of different mounting media.

Dr. Mouser gave a brief description of the laboratory he has just fitted up for prosecuting the study of the micro-organisms of disease. He concluded by extending a cordial invitation to the Society to examine the various appliances, and, on motion, the invitation was unanimously accepted, it being decided to hold the meeting of the 27th inst. at the laboratory, 707 Bush Street.

It was stated by Prof. Hanks that while visiting Verdi, Nev., recently, he had come across a fossil, diatomaceous earth of a pe-

culiar bright salmon-color, and there was every reason to believe that this deposit was the source of a sample of such earth which had been sent to the Society anonymously more than twelve years ago, and which had attracted considerable attention at the time by reason of its richness.

Among the objects exhibited were slides of diatoms and of quartz from Alameda beach, mounted by Dr. Riehl, and nine well-stained slides mounted by Dr. Stallard in further illustration of the subject of tuberculosis in fowls.

A committee was appointed to report at the ensuing meeting regarding the advisability of holding the annual reception of the society some time next month.

April 27, by invitation of Dr. S. M. Mouser the regular fortnightly meeting of the society was held in his extensive laboratory, President Wickson occupying the chair.

It was decided to hold the society's annual reception on the evening of May 28, next, and the President was authorized to appoint a committee to make the necessary arrangements.

The death of Dr. Allen Y. Moore, a corresponding member of the society, was announced, and remarks eulogistic of the deceased were made by various members.

Dr. Henry L. Wagner, who has recently completed an extensive course of study in the leading biological laboratories of Europe, drew attention to a new organism lately found by him, closely allied to the *Micrococcus tetragonus* which Koch has observed in connection with his investigations on the tubercle-bacilli. The cells of the new organism occur in characteristic groups of four, and its growth in gelatine is very destructive in the appearance of the colonies formed. Dr. Wagner also described and gave the formula for a new culture-medium devised by him, more particularly for use in the study of such organisms as found their natural pabulum upon mucous surfaces. Its principle characteristic was the substitution of an alkaline solution of mucin, for the peptone usually employed. Dr. Wagner received the thanks of the meeting for his interesting address.

The members then proceeded to inspect the methods adopted by Dr. Mouser in the study of bacteria and allied organisms. The various steam-filters, sterilizers (both hot-air and steam), incubators, etc., ranged along the sides of the laboratory, were duly shown and their operation described. The method of procedure is briefly as follows: Small portions of the material infected by the organism to be studied are placed with a needle-point, previously sterilized by

heating, either upon the freshly-cut surface of a boiled potato, which is then covered by a bell-glass, or into a test-tube partly filled with fluid gelatine, which is first shaken thoroughly so as to distribute the introduced germs as much as possible, and is then poured upon a glass plate where it hardens, and is also covered by a bell-glass. In either case the introduced organisms, rapidly multiplying by self-division, form small colonies, each original germ being the starting point of one. Up to this point, the admixture of foreign and undesired germs floating in the atmosphere, is unavoidable. It is, however, an interesting and very valuable fact, that the colonies respectively formed by different genera, and even species of bacteria and their allies, present marked differences of appearance even to the naked eye, so that there is little liability to error from this source. After the colonies have grown sufficiently to enable them to be identified, a test-tube partially filled with a solidified preparation of sterilized gelatine, agar-agar, or similar substance is quickly inoculated by introducing with a needle-point a minute quantity of material from what has been ascertained to be the desired colony on the potato or glass-plate. The test-tube is then closed by a wad of sterilized cotton or glass-wool and is placed in the incubator at the temperature best suited to the contained organisms. The growth of the latter is rapid and also distinctly peculiar in the different species, so that an experienced investigator, by holding to the light a tube containing a pure culture of such organisms, can determine the species merely by the appearance of the colony, which sometimes spreads over the top of the gelatine in the tube; sometimes grows only in the path made by the needle, and in other cases takes the form of a spiral, a nail, a bunch of grapes, etc. Throughout the entire process the utmost care is taken to prevent the introduction of germs other than the one to be studied. Every portion of the apparatus and the culture-media used are sterilized with the greatest precaution and even the hands of the investigator are bathed in germicide solutions at all the important steps of the procedure. When a perfectly pure culture of some germ has been thus obtained, the further study of its characteristics, both in the colony and under the microscope, becomes comparatively easy, and valuable experiments of inoculation upon living animals, etc., are made possible. The immensely valuable results already obtained by Pasteur, Koch and many others, are a guarantee of what may be reasonably hoped for in the near future by the study of a subject, the immense importance of which can hardly be over estimated.

A most cordial vote of thanks was unanimously tendered Dr. Mouser for his very interesting and instructive exhibition.

A. H. BRECHENFELD, *Secretary*.

ST. LOUIS CLUB OF MICROSCOPISTS.

THE following gentlemen met at the St. Louis College of Pharmacy, Tuesday evening, May 3rd, and organized the St. Louis Club of Microscopists: H. M. Whelpley, president; J. C. Falk, vice-president; V. J. Mueller, secretary; Frank Davis, treasurer; E. T. Jester, Otto Meyer, H. L. Wichmann, Wm. Ilhardt, and A. C. Speth. The club will meet on the first Tuesday of each month, and pay special attention to microscopical technology and the examination of drugs.—*National Druggist*.

ELEMENTARY DEPARTMENT.

FOURTH LESSON.

“CLEANLINESS IS AKIN TO GODLINESS.”

APPARATUS and materials required.—1. One ounce of chloroform-balsam. 2. One ounce of oil of cloves. 3. One pint of spirits of turpentine. 4. One ounce of a one-half per cent. solution of silver nitrate. 5. One-half dozen porcelain butter-dishes and a like number of glass salt-cellars.

1. Chloroform-balsam can be prepared by taking a quantity of Canada balsam—a yellowish, clear, viscid turpentine—and to it adding sufficient chloroform to make it thin enough to drop slowly, and without stringing, from the point of a glass rod. Chloroform can be added from time to time to supply that lost by evaporation. A good receptacle for this liquid is a wide-mouthed bottle, fitted with a hollow-glass stopper. Now take a glass rod and, by heating it, draw it out to a tapering point, and break off that it be just long enough to reach from the bottom of the bottle to the interior of the stopper when fitted in. The rod can be thus left in the bottle and kept free from dust. If one prefer, a capped bottle, with glass pipette, can be purchased in the shops for fifty cents. 2. The oil of cloves should be pure and of light color. That sold by the various dealers in microscopical goods will be found the most satisfactory. 3. As light decomposes this solution, it should be kept in a dark place or in a bottle wrapped in blue paper. 4. The butter-dishes and salt-cellars should be of good quality and free from lumps and discolorations. The salt-cellars should have a deep bowl with

sloping sides. Provide, also, a number of glass squares sufficiently large to serve as covers for the dishes.

SIMPLE MOUNTING AND STAINING.

In this lesson will be discussed the art of making simple and permanent mounts. As the method to be here described will apply to all balsam mounts, however complicated the preparation of the specimen may have been, the reader will do well to learn thoroughly the rationale and order of the various stages employed.

From a cat or other animal obtain a piece of mesentery. Wash carefully in distilled water, and then lay it in one of the dishes and cover with the silver-nitrate solution. Leave it there for about two minutes, then remove and wash again. Now place it in a salt-cellar full of distilled water, cover with a glass plate and expose to the light—not direct sunlight, however—until it assumes a light-brown color. This usually takes a number of hours, during which time the water may be changed a few times. The color appearing, the membrane will then have been sufficiently stained to show the outlines of the endothelial cells found on its surface. This result will have been brought about by the fact that the silver salt combines with the intercellular substance to form an albuminate, which, white at first, darkens on exposure.

The specimen is now to be put through the following course: (*a.*) Immersed in alcohol; (*b.*) transferred to oil of cloves or turpentine; (*c.*) mounted in chloroform-balsam.

The rationale of all this is: The specimen is treated with oil of cloves or other essential oils, as organum, cedar, etc., or with turpentine, to render it more transparent, these substances possessing great refractive powers. If the reader wishes to get a clear idea of the transparency thus induced, let him put a piece of unstained mesentery into the oil—of course, after immersion in alcohol—and he will notice that it seems to melt away as it becomes permeated with the oil, and finally to disappear altogether.

Before the specimen can be put in the oil it must, of course, be freed from the water it obtained when being washed. Alcohol, having a great affinity for water, is employed for this purpose. But to do this the alcohol must itself be comparatively anhydrous. Absolute alcohol, which contains not more than .2 per cent. of water, is the surest, but that containing not more than 3 per cent. will answer if the specimen be allowed to remain in it for a longer time.

So important is this process of dehydration—for on it depends the future preservation and transparency of the object—that it must be carefully performed.

As has been said, the great *desideratum* is comparatively anhydrous alcohol. The alcohol used for this purpose should be kept in a tightly-corked bottle and in a dry place, and when poured into the salt-cellar for use should be quickly covered. All this to prevent the absorption of moisture from the atmosphere. The vessel should be carefully dried and the specimen, before being immersed, should be dipped into ordinary alcohol in order to remove the grosser portion of water. If carefully done, ten minutes will be sufficient time to prepare the specimen for the oil; but it will be as well to leave it for several hours. When the oil has rendered it perfectly clear—which takes from five to ten minutes—it is mounted in balsam and laid away to dry.

Now as to the manner of doing all this. The specimen can be handled in the silver solution and waved around gently in the distilled water when being washed, by means of a needle fixed in a holder passed beneath it. When in the solution—and this will apply to all stains mentioned hereafter—and when being exposed to the light, it should be carefully flattened out, that every portion of the surface receives equal treatment. Before removing to alcohol is the time to see that all wrinkles and overlapping portions are corrected. To accomplish this, take a rectangular piece of paraffine, or tissue-paper about one-half again as long and somewhat wider than the specimen, grasp lengthwise with the forceps and gently pass under the object. With a fine camel's-hair brush carefully smooth out and arrange it on the paper and then withdraw slowly from the water. With a little practice this operation can be easily performed, as the specimen is soft and pliable. Now dip it quickly into the ordinary and then immerse slowly in the absolute alcohol, which has been previously put into a salt-cellar. Do not now urge the specimen from the paper, but wait a moment and the alcohol will set or harden it so that it will generally slide off of its own accord. If not, a gentle to-and-fro motion will suffice.

After becoming dehydrated it can be removed in the same manner to the oil or turpentine. If the object is a small one, however, it can be lifted out with a needle, as it will not curl or wrinkle, having been stiffened by the alcohol. Before placing in the clearing medium it will be well to remove some of the alcohol by touching the specimen to a blotter.

NOTE.—As to the choice between the essential oils and turpentine, it may be said that the former has the advantages of clearing the specimens just enough and leaving them tolerably pliable; their disadvantages are their high cost and color. The latter requires

that the specimen be more completely dehydrated, and then it oftentimes renders it too transparent and always too brittle. On the other hand, it is colorless and very cheap. The beginner is advised to practice with turpentine, as at small cost large quantities can be used, thus facilitating the manipulation of the object.

Now carefully cleanse a slide—or “slip,” as it is more properly called—and a cover-glass. By this time the specimen will have been made sufficiently transparent and ready to mount. On a fresh paper the size of the first one used, and with a fine camel’s-hair pencil, arrange the object. Draw it carefully from the medium and touch the paper lightly to a blotter to remove the superfluous oil. Now lay it gently on the center of the slip, *paper uppermost*. Without releasing from the forceps the paper can generally be peeled off, leaving the specimen behind nicely arranged and in order. If the paper sticks, a little urging may loosen it, being careful not to move the object from the center of the slip; if not, then lay aside the forceps and *gently* press a blotter on the paper, thus fixing the specimen to the slip and removing much of the oil which holds it to the paper. A needle-point inserted under the edge of the paper will now turn it up, that it can be grasped and removed. Now add two or three drops of the chloroform-balsam and put on the cover-glass as described in the second lesson of these papers. Press the cover down so it fits evenly and set away to dry.

If too much balsam be used, it will exude at the edges of the cover. This can be scraped away when dry. If too little be employed, more should be added at once by touching a drop to the edge of the cover. Capillary attraction will carry it under. With practice, however, it will be possible to judge of the exact amount required to fill out nicely. It will be well for the first few days after mounting to examine the slide carefully to detect shrinkage of the balsam. If vacuolations are found they should be filled with balsam as above described.

In balsam-mounts included air-bubbles should create no concern, as they usually pass out without treatment. This fact, however, is no excuse for carelessness in allowing the bubbles to form.

The specimen is now finished, and when labeled and kept from the dust and light will endure almost forever.

In the writer’s opinion, Canada balsam is the best medium for permanent mounts. True, glycerin is often necessarily employed for very delicate specimens or those which have been stained with certain dyes. But such mounts are hardly as permanent, though

Beale, I think, claims to have some twenty-five years old and still perfect; and they require a hermetical ring, which is of doubtful artistic value.

Dammar varnish has been used in place of the balsam. This has the advantage of being perfectly colorless. Yet the mounts are not permanent, and one is greatly troubled with air-bubbles, which, unlike those in balsam, will not disappear spontaneously.

HINTS.—CENTERING SPECIMENS.—As it greatly enhances the beauty of a slide if the specimen be well centered on the slip, the reader will find an article by Prof. Gage in the last December number of this journal describing a method whereby this centering can be done easily and with great accuracy.

CLEANING GLASS.—Balsam, when fresh, can be removed from slips and covers with turpentine used liberally. Polish with a soft rag. The following mixture will be found effective when the balsam is dry: Potassium-bichromate, four ounces; commercial sulphuric acid, four ounces; water, one pint. Slips and covers can be placed in this and left indefinitely. Even new glassware, apparently clean, will be improved by treating with the above. Liquor potassæ and other strong alkalies cannot be recommended, as they oftentimes etch the glass, thus making it worthless.

EDITORIAL.

MAKING A MICROSCOPIST.

IN his paper before the A. S. M., on the methods of making microscopical societies successful, Dr. R. H. Ward offers some very pertinent suggestions which will prove of great value to officers who have the good of their society at heart. "There are," says Dr. Ward, speaking of societies in general, "some who feel the need of such associations, but in no city in America, at least, are there yet enough persons qualified for the highest duties of membership to place the enterprise, where its leaders would wish, fairly high among the great learned bodies of the world." The question arises, what are the qualifications necessary to make a person fit for the highest duties of membership in a local society, and to place his efforts above the stigma of dilettantism? Probably in no country in the world is the microscope so generally owned and employed as in the United States, but again, we believe, it would be difficult to find a land where its use is put to so little purpose as with us. To own a high priced microscope and numerous accessories, does not make the

possessor a microscopist. We are often asked by those who have become interested in practical microscopy by a display of beautiful objects, or through some accident, the best line for them to pursue in taking up the study, and the proper books to aid them in their work. Our own ideas on this subject, based on a close observance of methods employed in the great laboratories abroad, and by the most successful scientists of this country, may be briefly stated. The student should, if possible, place himself under the personal guidance of an experienced teacher in a laboratory sufficiently equipped with necessary reagents and apparatus. When such a course is impossible or impracticable, the following plan should be pursued :

(A.) A thorough familiarity with the microscope, its construction, manipulation, and the care of its various parts, should be acquired. In this we do not include a profound knowledge of microscopical optics, but a sufficient acquaintance with lenses, their powers of refraction, magnification, etc., to enable the beginner to appreciate what he sees by their use. To assist in this we know of no better help than Mr. Bausch's "Manipulation of the Microscope." This little book furnishes in brief and concise language the most salient points above mentioned. Gage's "Notes on Microscopical Methods" furnish information which the student should possess at the outset, but which is given in no other manual with such clearness and in so condensed a form. Usually years of work are necessary in acquiring the knowledge which is here set forth in a few pages. Mayall's Cantor Lectures are also useful, giving, as they do, a complete history of the development of the microscope.

(B.) The next step is of a more practical nature, the handling and preparing of objects for examination. In our opinion it is a mistake for the beginner to invest in the voluminous and high-priced works on this subject, which may contain, it is true, matter invaluable to the microscopist, but in far too elaborated form for the mental digestion of the tyro. There are many little books which will be of much service at the start. Of these we may mention Manton's "Beginnings with the Microscope," and James' "Elementary Microscopical Technology."

(C.) It is usual for the beginner to waste much time in examining all sorts of objects, pretty in themselves, perhaps, but of no value whatever, in an educational sense, to the observer. We believe that whatever the bent of the student's mind, whatever his intentions in regard to his ultimate work, the high road to success in any department lies through a knowledge of animal histology. We urge those who contemplate taking up the microscope, or who have already

begun in an indifferent way to examine objects without definite purpose, to consider this seriously. Material is abundant, the manipulations necessary at the start are such as are easily acquired; a knowledge of histology is essential in the study of biology, microscopical botany, and all of the subdivisions of microscopical science. As helps in this, Gage's "Notes on Histological Methods," together with Stricker's, Schafer's, Frey's, Stowell's and other histologies will be necessary.

At this point Friedländer's "Use of the Microscope" will be found useful. When the student has acquired a fair knowledge of animal tissue, he is prepared to decide what particular branch of microscopy interests him the most, and is fitted to begin his researches with a foundation knowledge which will prove of inestimable value to him. If biology is his choice, let him begin with Huxley and Martin's valuable hand book, Foster and Langley's "Practical Physiology," Foster's "Elements of Embryology," Balfour's "Comparative Embryology," Packard's "Outlines," with Whitman's "Methods in Microscopical Anatomy and Embryology." If botany is his preference, Poulsen's "Botanical Micro-Chemistry," Bessey's "Botany," Strassburger's "Microscopic Botany," and Behren's "Guide to the Microscope in Botany," will render him service. Those who interest themselves in bacteriology, will find Dolley's "Technology of Bacteria Investigation," Crookshank's "Practical Bacteriology," and Woodhead and Hare's "Practical Mycology," the necessary hand books.

Nearly every department has its exponent in the current microscopical literature, but an enumeration of all these works would not prove of interest. Sufficient has been said, however, to indicate how workers with the microscope may qualify themselves for work which will stand though tested by fire, and by means of which they may be fitted for the highest duties of membership in any scientific body. It is only by careful attention to the minutiae that success is ever attained in this life, and success as a microscopist depends upon the careful observance of details, and a correct interpretation of facts, a condition only to be obtained by long and faithful study. But the pathway to these high attainments is not thorny,—no tale of Arabian Nights is half so fascinating, no study so helpful and broadening to the intellect, no work so remunerative in pleasure-giving and personal satisfaction.

WE learn that the microscopical society of Baltimore, Md., which has been in danger of dying a natural death, has, through

the energy of a few of its members, received a new impetus, and will continue to hold regular monthly meetings. We trust that this society, which numbers among its members so many distinguished microscopists, will carry on the work with renewed zeal. Reports of its transactions will appear in future in this journal.

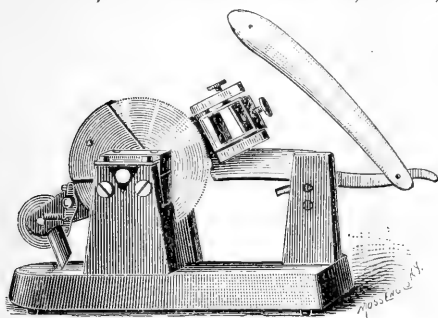
THE editorial rooms of THE MICROSCOPE have been moved to 25 Washington Ave. Correspondents and exchanges will please take notice. Specimens for examination, exchange, books for review, etc., should be directed as above, and not to the publishers.

ACKNOWLEDGMENTS.—Mr. B. F. Quimby, of Chicago, Ill., for a mount of the Croton-bug, one of the most beautiful insect preparations that we have ever seen. The donor has our apologies for tardy acknowledgments. From Jas. E. Reeves, M. D., Wheeling, W. Va., fine slides of the bacillus of typhoid from gelatine culture, and from the 30th potato culture. In the latter case there is a decided increase in size, the potato evidently offering a more acceptable pabulum to the bacterium.

TECHNOLOGY.

RYDER'S AUTOMATIC MICROTOME.

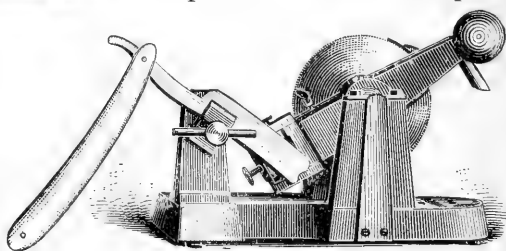
Prof. John A. Ryder, of the Biological department of the University of Pennsylvania, has kindly furnished us with the cuts of his new, automatic microtome, which, for price and action, must



necessarily be considered the best and cheapest instrument now on the market. The following description is taken from the *American Naturalist*, with additions by Prof. Ryder :

The working parts are an oscillating lever, which is provided with a clamp at

one end into which the paraffine-holders are adjusted, and at the other with a simple handle. This lever rests upon trunnions on either side, and these in turn rest in



triangular notches at the top of the two pillars between which the

lever oscillates. At the cutting-end of the lever a spring pulls the lever down and effects the sectioning and also the adjustment for the next section. The lever is pushed over and adjusted for the successive sections by a hollow screw, through which passes the trunnion on the side away from the knife. This screw is fixed to a toothed wheel, three inches in diameter, which revolves close by the side of the oscillating lever. The toothed wheel and screw is actuated by a pawl fixed to the side of the lever near the handle. The number of teeth which this pawl can pass in a single vibration downward is controlled by a fixed stop, screwed into the under side of the oscillating lever near the handle: the end of this stop striking on the top of the bed-plate thus brings the lever to rest at a constant point in its downward excursion. An adjustable sector by the side of the toothed wheel throws the pawl out of gear after a given radius of the wheel has been turned through an arc embracing the desired number of teeth. This adjustment is also effected before the block, containing the object to be cut, reaches the edge of the knife. The adjustment for the next section is therefore effected while the surface of the block is not in contact with the under side of the knife, so that no flattening or scraping effect is produced on the surface of the block in its upward passage past the knife.

The movement of the vibrating lever being arrested at each down stroke at one point, and the pawl which catches into the notches in the toothed wheel being released at any desired point by the action of the adjustable sector, it is possible to adjust the apparatus with great accuracy for cutting sections of any desired thickness. If a given radius of the wheel is moved through the arc embraced by a single tooth, sections are cut having a thickness of only $\frac{1}{10000}$ of an inch, or .0025 mm.,—a thickness which is only practically possible with paraffine embedding and a very keen razor. If more teeth are taken by the pawl, any thickness of section is possible up to about $\frac{1}{40}$ of an inch, or .0625 mm.*

A freezing-attachment, which has lately been appended to the apparatus, shows that frozen sections can be made with as great rapidity and success as those cut from objects embedded in the paraffine block, and very nearly, if not quite, as thin. The freezing attachment is as simple and efficient as the self-adjusting and cutting devices of the instrument. Other auxiliary apparatus makes it possible to cut celloidin sections. This is effected by means of alcohol conducted by a tube from a reservoir to the knife, over which the fluid will run and drain into a tray below in such a way as not to

* The screw which adjusts the block for cutting has exactly fifty threads to the inch, and there are two hundred teeth on the periphery of the toothed wheel. The value of a single tooth is, therefore, $1.50 \times 1.200 = 1.10000$ inch.

come in contact with any other parts of the machine. This tray fits into a recess in the side of the bed-plate of the instrument just below the knife, and into this tray the celloidin sections may be allowed to drop as fast as cut.

The paraffine-holders are square and seven-tenths of an inch in diameter, so that a block of that size may very readily be sectioned. For the botanist, one of these holders is provided with a movable side and screw for clamping objects, so that rather tough stems may be firmly held between blocks of cork, while the more delicate vegetable tissues, or such as must be embedded in fresh carrot, soaked in gum and hardened in alcohol, may also be firmly held for sectioning by the same device, provided the pieces of carrot are first trimmed into the right shape. The same style of holder is equally applicable for holding the corks—if properly trimmed—upon which tissues are embedded in celloidin or in gum. This style of holder also enables one to embed very long objects entire in paraffine,—such as earth-worms,—and to cut them as a single piece, provided the surrounding paraffine is carefully trimmed so as to have two opposite sides parallel. An object six inches long and three-fourths of an inch in diameter embedded in this way may be cut into an absolutely continuous series of sections without losing any essential portions. This is accomplished by slipping the block through the quadrangular clamp for the distance of half an inch every time a half-inch of the object has been cut off in the form of sections. One-half inch is the length of block which can be cut at one time without readjusting the feed-screw which moves the block and vibrating lever over towards the knife, the whole being kept firmly in place against the face of the hollow screw by a strong spring which presses against the end of the trunnion on the outside of the iron pillar on that side of the instrument where the knife is fastened, so that all the sections are of exactly the same thickness from first to last. Cutting up large objects in the manner above described is not possible with any other form of microtome yet constructed.

Almost any section-knife,—wide, or narrow-bladed,—will fit into and be firmly held by the knife-clamp, which is, however, intended more especially to hold an ordinary razor. The best razors for cutting sections have been found to be those of the best make only, such as Wade & Butcher, or Joseph Rodgers & Sons, of Sheffield. Only such razors as hold an edge well should be used.

For ribbon-cutting by the paraffine method the block containing the object, after it is trimmed and soldered to the paraffine with

which the holder is filled, by means of a heated wire, is covered with a thin coat of soft paraffine or "paraffine-gum," and of which "chewing-gum"* is made. This enables one to cut ribbons of any desired length, since the softer paraffine at the edges of the successive sections sticks them together by their margins as fast as they are cut.

The ribbons may be allowed to fall upon a slip of paper, which may be drawn out, as fast as the sections are cut, from under the bed-plate of the instrument, beneath which there is a space left for this purpose between the three toes or tripod upon which the whole apparatus rests. The edge of the knife also remains in the same plane, no matter at what angle the cutting-edge is placed with reference to the direction in which the block to be cut is moved, just as in the best forms of the sledge microtome. Prof. Ryder writes us that in order to control the cutting and keep the sections from curling, a camel's-hair pencil may be held close to the blade. This is found to answer ordinarily, but later experience has shown that it is possible to attach a section-flattener in the form of a roller of hard rubber, which turns loosely on a rod held parallel with the knife edge. The roller is placed with its center somewhat in advance of the knife edge, the rod supporting it may be fastened to the back edge of the knife or be clamped in the position of the support which holds the tube conveying the alcohol to the knife when cutting celloidin sections.

In cutting celloidin or collodion masses, it has been found that the greater the inclination of the knife the better the results, and it may be found expedient to devise a special form of clamp for cutting celloidin. For paraffine cutting, this instrument has no equal for practical efficiency.

A new, paraffine bath, which has also lately been devised by Prof. Ryder, promises to become an important aid in embedding. This new device does away with the ordinary form of water-bath as used at Naples ; it also does away with the need of a thermostat, the paraffine itself serving to indicate the place where it is safe to place an object to be embedded. A description with a figure of this new device will appear in the May number of the *American Naturalist*.

The advantages which this new instrument offers, are, briefly, comparatively small cost, great efficiency, rapidity, and accuracy. One hundred sections per minute may very readily be cut with it.

* Chewing-gum may be rendered available for this purpose if it is melted at a temperature somewhat above boiling, when the sugar which it contains will separate as caramel, leaving the pure paraffine-gum, which may be drained off and used as directed, if the manipulator should find it difficult to get the paraffine-gum of commerce.

Its simplicity of construction, with few wearing parts, and slight liability to get out of order in the hands of inexperienced persons, will also commend it to the teacher and investigator. Experience has already shown that those once using it can scarcely ever be again induced to use the most efficient sledge or automatic microtomes of different design if they can have access to this instrument. This device is made by Mr. Zentmayer, 209 south Eleventh street, Philadelphia, whose name is a sufficient guarantee of the workmanship employed in its construction, and to whom those interested are referred.

ABSTRACTS.

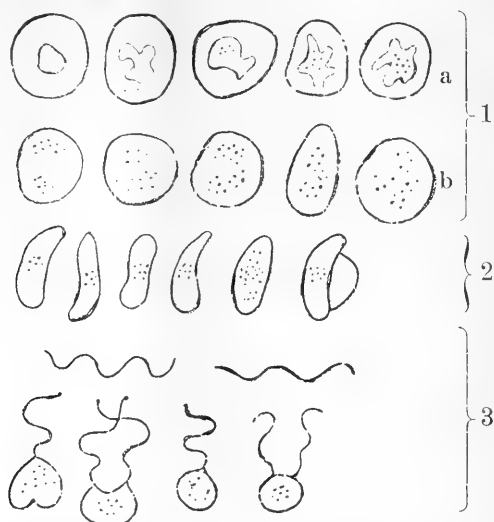
THE MICRO-ORGANISMS OF THE BLOOD IN MALARIAL FEVER.

Councilman, in studying the blood of malarial patients with reference to the micro-organisms pointed out by other observers, has thrown much light upon the subject. Eighty cases examined, embraced all forms of malarial disease common to the vicinity of Baltimore, Md. These cases were divided into intermittent fever, remittent fever, malarial cachexia, and comatose malarial fever. The blood in most cases was examined fresh, although numerous examinations were made after drying on the cover slip, and subsequently staining with some of the aniline colors. The cases of intermittent were nearly all of the tertian form, only a few, four in all, were quotidian. There is considerable difference in the blood in intermittent fever, depending on the length of time from the beginning of the attack. In the first days of the attack plasmodia (the amoeboid organism of Marchiafava and Celli) are found only during the chill. They are small and extremely difficult to see, the difficulty being increased by irregularities on the surface of the red corpuscles, and a vacuolation, or what appears to be this, inside of them. They may or may not be pigmented, the pigmented forms being seldom found in the first few paroxysms, but later most of them are pigmented. The plasmodia appear as pale homogeneous masses inside the red corpuscles. They are either round or irregular in shape, the irregularities taking the form of round knob-like projections. Their size varies from one-third to one-fourth the diameter of the corpuscle, up to a size almost or wholly filling the corpuscle, which in this case is larger than ordinary and almost completely deprived of pigment. Sometimes the corpuscle appar-

ently contains two or more of these bodies, but on staining it is seen that the apparently isolated masses are connected by extremely slender protoplasmic filaments. The index of refraction of these bodies is almost the same as that of the blood corpuscle which contains them, and they are most easily seen when round. The most remarkable thing about them is their amœboid motion. This is readily seen, and takes place with about the same rapidity as the movements of the ordinary fresh-water amœba. While watching them I have seen them disappear, and then slowly reappear in the corpuscle. This is easily explained by their spreading out in a thin layer, their refraction then being so low that they cannot be distinguished from the surrounding corpuscle. As they contract and become thicker they again become visible. In such cases the appearance of amœboid movements will settle the question. Some care is necessary in collecting the blood. The cover-slip should be clean, a very small amount of blood be placed on it, and applied immediately to the slide. When the amount of blood taken is so large that the corpuscles lie over each other, or when they are in rouleaux, it will be impossible to see the bodies. They are much more readily seen in stained preparations. These are made by drying a thin film of blood on the cover-slip, taking care to have not more than a single layer of corpuscles, heating the cover, and staining with some one of the aniline colors, for which purpose fuchsin or methylene-blue will give the best results. At this early stage of the disease, the bodies are not found in the period of apyrexia, and appear to be most numerous at the height of the algid stage.

After the patient has had several chills the bodies are found also in the interval, but in greatly less numbers than in the paroxysms. They are much more easily seen and present numerous differences from those just described. The small non-pigmented forms are found, but in addition, large ones which almost or entirely fill up the body of the red corpuscle. These large forms are always pigmented, the pigment generally taking the form of minute black rods. It may be irregularly distributed through the body, or collected in a mass at one side. The corpuscles containing these large bodies are generally slightly swollen, and very pale, at times apparently entirely wanting in color. The pigment renders the detection of these bodies a matter of comparative ease. In using the Abbè illuminator, the diaphragm may be thrown out entirely, and only the pigment sought for, and when this is found, the char-

acter of the body containing it may be ascertained by replacing the diaphragm. Fig. 1b shows the plasmodia when looked at without the diaphragm, a. with diaphragm.



The pigmented granules often exhibit the most marked Brownian movement. The amœboid movement can be readily followed even without the use of the diaphragm, by observing the relative position of the pigment masses. Fully two cases of well-marked remittent fever came under observation. In both these, and in all the cases of malarial cachexia, bodies were found which differed from those just described. In preparations of the blood, taken at any time, long bodies, usually curved in the form of a crescent, were found. These bodies are highly refractive, homogeneous, with sharp outlines, and always contain pigment. This is usually collected in a bunch in the middle of the body. In a few of the bodies the mass of pigment was in the center, and from this long lines radiated toward the extremities. These bodies are from one and a half to three times as long as the diameter of a red corpuscles, and not wider than the half of this diameter. Though they are narrower at the ends than in the middle, the ends are not pointed but slightly rounded. While this is the general character, they present considerable irregularity, some being nearly round, others elongated and straight. It was in the oval one that the radiating arrangement of the pigment was most frequently found. They are free in the blood and have no power of motion; they are

most generally found in the midst of clumps of red corpuscles. In several cases a faint, delicate line, curved the other way, was seen connecting the ends of the crescents. Marchiafava and Celli also describe these crescentic forms, and suppose them to be developed from the plasmodia (2).

In two cases of intermittent fever the crescents were found in the blood at the same time that the corpuscles contained plasmodia.

* * * The number of crescents varied much in different cases. In all of the fatal cases the crescentic bodies were found in great numbers, along with other bodies which were seemingly identical with the hyaline bodies found in the capillaries after death. Several times in the same preparation with ciliated bodies, free cilia were seen. The latter appeared to be the same size as those attached to the bodies, and like these had small nodes among them. They moved rapidly through the blood, sometimes with a spiral motion similar to that of a spermatozoon (3). In their onward motion they often came in contact with a red blood corpuscle and would violently indent this, or they would agitate a whole group of corpuscles.

The motion of the cilia, both when attached and free, seemed to have a certain rhythm: they would move slowly at first, the motion increasing until it became very rapid, then it would become slower and nearly cease, again to become very rapid. In addition to the motion of the filaments, a wave-like motion of the periphery of the body was often seen. * * * * *

The importance of these recent discoveries in malaria can hardly be overestimated. Not only is a new territory opened to the pathologist, but to the clinician the sure means is given, by a simple examination of the blood, of diagnosing accurately the most complex, and sometimes most terrible of diseases, and in which more depends on a speedy and certain diagnosis than in any other disease. Not only is he able to designate the disease as such, but in most cases the particular form.—*Med. News.*

A WRITER in the *Dental Review* in an interesting article, "Microscopy in Dentistry," says: The microscope has revealed much to the dentist regarding the teeth and their development. It has much more to disclose. It is telling us much regarding the diseases of the teeth and the environing tissue. It has recently shown us the origin of one of the acids which is found in the mouth. We are just entering a field in which there is much work to be done, and truly the laborers are few. Large opportunities

await those who have the ability and the will to work with hand and brain. It is certainly desirable that the dentist should have a clear conception, from his own observation under the microscope, of the minute form-elements of the tissue upon which he is daily operating. The satisfaction of being in possession of this knowledge will fully repay the time and labor given in this direction. If you are giving time to the criticism of brother practitioners, to speaking of the wonderful operations you are performing; to wire-pulling and politics, drop these, and give the time thus spent to the microscope. It will rest you when weary from too much labor; it will cultivate your mind and give it more breadth.

ANTS AND ULTRA-VIOLET RAYS.—While Sir J. Lubbock considers that ants perceive the ultra-violet rays by means of their eyes, (*Arch. Sci. Phys. et Nat.*, XV., 1886,) Graber finds, by removing these organs from tritons, etc., that it is by the skin that these rays are perceived. Prof. A. Forel has made experiments in order to answer the question whether ants perceive the rays by the means of their eyes, or by the skin; and he finds that it is mainly by the former organs, but admits that “photodermatic” perception may accompany the optic sense. *Camponotus ligni perdis* and *Formica fusca* served for his experiments, and a “Solution d’esculine” was used for absorbing the ultra-violet rays.—*Jr. R. M. Society*.

NEW FORAMINIFER.—Prof. H. Blanc, (*Arch. Sci. Phys. et Nat.* XVI., 1886,) describes a new Foraminifer, dredged in the Lake of Geneva, from a depth of 120.200 metres. He names it provisionally *Gromia Brunneri*, but thinks that it will probably deserve to form a new type of this genus. It is of large size, from 0.3 mm., to 1.0 mm: it varies from flask-shaped to globular, and has a single opening. The shell, slightly lemon-yellow in color, is formed of fine particles, probably silicious, glued together. The protoplasm contains a single nucleus, and several vacuoles; it covers the shell and forms a network similar to that of other species of *Gromia*.—*Jr. R. M. Society*.

NEWS AND NOTES.

PROFESSOR TYNDALL has been obliged to resign his position at the Royal Institute on account of failing health.

PROFESSOR WILLIAM ASHBURNE, the well-known mining engineer of the Pacific coast, is dead, aged 56 years.

DR. BROWN-SÉQUARD has just been elected president of the Société de Biologie, to serve for five years.

THE April number of Pelletan's *Journal de Micrographie* contains an admirable portrait of Prof. Mathias Duval.

THE Rochester, N. Y., *Post-Express*, of April 5th, gives a column account of the Gundlach optical works of that city, which is very interesting reading.

PROFESSOR ERNEST HAECKEL, of Jena, has been studying the lower forms of animal life in the Levant, during the past winter.

THE marine laboratory of the John Hopkins University has been opened at Nassau, New Providence, West Indies, under the direction of Dr. W. K. Brooks.

A NEW departure is the use of the polariscope in the detection of adulterations in essential oils. Mr. Albert M. Todd gives an interesting sketch of his experiments in this line in the *American Journal of Pharmacy* for April.

PROF. NEARIANI SEMNOLA, Professor of Experimental Therapeutics in the University of Naples, will deliver a general address before the Ninth International Medical Congress at Washington, on Bacteriology and its clinical therapeutics.—*No. W. Medical Gazette*.

PROFESSOR ALEXANDER AGASSIZ, director of the museum of zoology at Harvard, has been made a D. Sc. by the University of Cambridge. In introducing him, the public orator referred to him as one of whose work it might be said, '*Merses profundo, pulchrior evenit.*' The allusion was to Prof. Agassiz' investigations of the mysteries of the ocean.—*Science*.

DR. E. KLEIN, who found a micrococcus in the matter from the ulcers of a sick cow, to the milk of which a scarlet-fever epidemic was attributed, has now discovered a similar form in the blood of scarlet-fever patients. Inoculation of mice with the micrococcus from each source gave the same results. If this micro-organism is found to be the cause of the disease or carrier of the contagion, its discovery is hardly second in importance to that of the *B. tuberculosis*, or the comma bacillus.

THE tenth annual session of the Martha's Vineyard Summer Institute will begin July 11, and continue for five weeks. Among the courses announced we notice the following: Mr. Edward S. Burgess, on botany; Geology and Mineralogy, by Profs. W. A. Brownell and A. E. Furner; Microscopy, by Rev. J. D. King and Miss Ella M. Drury; Zoology, Prof. William B. Dwight. Full information of these courses, which are admirably adapted to the needs of teachers during vacation, may be had by applying to Mr. B. W. Putnam, business agent, Jamaica Plain, Boston, Mass.

A WRITER in the *Scientific American* suggests as a substitute for a revolving table, the use of a "Japanese or tin tray, large enough to contain both microscope and lamp, so that the relation of both may be preserved while the tray is moved to bring the instrument into position for different observers, by simply sliding the tray on the table."

BOOK REVIEWS.

ELEMENTARY MICROSCOPICAL TECHNOLOGY, a manual for students of Microscopy, by Frank L. James, Ph. D., M. D., President of St. Louis Society of Microscopists, editor *St. Louis Medical and Surgical Journal*, etc. pp. 107, price \$1, cloth.

This little volume constitutes Part I. of a work on general microscopical technology, and is devoted to the subject of preparing and mounting microscopical specimens; or, as the author puts it in the title, "The Technical History of a Slide, from the Crude Material to the Finished Mount." It is intended for elementary instruction, and most admirably suits the purpose, for the doctor has not only written clearly and with great patience as regards detail; but has wisely determined not to presume on any knowledge which the reader may possess of the subject in hand. *Every point*, however trivial it may seem to the practiced hand, is carefully explained. In this lies the principal merit of the book. It does not seem possible that an intelligent student, following the directions as here laid down, could go far astray. As the author is an active worker in Microscopy, we are not surprised to see some new ideas and methods, as well as many improvements of old ones. We are sorry to note, however, that the work does not seem to have been as carefully edited as might be. The proof-reading has been careless in places, and the type used could have been fresher. These defects will doubtless be corrected in future editions. We cordially recommend it to all, and especially to beginners.

PROCEEDINGS OF THE AMERICAN SOCIETY OF MICROSCOPISTS, Ninth Annual Meeting, 1896.

Every American microscopist who glances over the subject matter of this record of the last meeting of the American Society should feel proud that it is American. Though the study of higher Microscopy does not, in this country, prevail to the extent one could wish, yet the volume before us gives proof that we do not entirely lack leaders in the science. And we are to be congratulated that, as a rule, the leaders will consent to lead. Though we miss in this volume some well-known names, yet are their places well filled with others both old and new. Among the more exhaustive papers are

Prof. Burrill's presidential address on "Bacteria and Disease," which has already appeared in the columns of this journal, and Dr. H. L. Smith's "A Contribution to the Life-History of the Diatomaceæ," with very artistic plates, which will bear most careful reading. Prof. Rogers discusses "A Method of Dealing with the Question of Temperature in the Comparison of Standards of Length," and Marshall D. Ewell has two contributions studying centimeter-scale "A." Both of these gentlemen write for the few. H. A. Weber and Thomas Taylor continue the controversy of last year on butter-crystals, and furnish two excellent plates in support of their views. The other papers are devoted mostly to practical subjects, and contain many new and valuable suggestions to the workers in Microscopy. It makes a very creditable volume.

THE PHYSICIAN'S LEISURE LIBRARY. Detroit: Geo. S. Davis.

Practical Bacteriology, by Thos. E. Satterthwaite, of New York, is an effort to extend more widely an interest in this most important branch of medicine. The author has made no special efforts in the direction of originality of matter, but has introduced into the little work short accounts of the material, apparatus and method of general bacteriological work, gleaned from various sources. The limits of the book precluded anything but a short introduction to bacteriology and as such only can it be criticised. The author is an expert technologist and has selected his material well. In the efforts to condense, however, some of the chapters have been made decidedly unsatisfactory, and would be but feeble guides to the beginner. The low price of the book and the fact that it will reach many physicians unacquainted with the first principles of bacteriology, will probably stimulate some to more thorough study on points of importance. The general appearance of the book is fair, but the proof-reading was very poorly done.

REPORT OF THE COMMITTEE ON DISINFECTANTS, presented at the Fourteenth Annual Meeting of the American Public Health Association, held at Toronto, Canada, October, 1886. Reprint.

Contains information of value to every physician.

THE NEW ENGLAND MAGAZINE, double number for April and May.

Presents an attractive variety of reading matter which will be found of especial interest to every New Englander by birth or adoption.

A CASE OF BRONCHO-PULMONARY MYCOSIS, by William F. Waugh, M. D. Reprint.

PROCEEDINGS OF THE SANITARY CONVENTIONS, held at Coldwater and Grand Rapids, Mich., 1886.

BAKED BEANS, a serio-humorous medical paper, by Ephraim Cutter, A. M., M. D., New York: W. Kellogg. Reprint.

ORATION DELIVERED BEFORE THE ALUMNI ASSOCIATION of the Medico-Surgical College of Philadelphia, by Dudley S. Reynolds, A. M., M. D. Reprint.

RAISING DIATOMS IN THE LABORATORY, by Prof. Samuel Lockwood. Reprint.

FEEDING PATIENTS AGAINST THE APPETITE, by Ephraim Cutter, M. D. Reprint.

PERSISTENT PAIN AFTER ABDOMINAL SECTION, by James B. Hunter, M. D. Reprint.

CORRESPONDENCE AND QUERIES.

DR. M., PITTSBURGH, PA.—Dr. Carter's injecting fluid is prepared in the following manner: Pure carmine, 60 grs.; liq. ammonia fort., 120 grs.; glacial acetic acid, 86 minims; solution of gelatine (1 to 6 water), 2 ozs.; water, $1\frac{1}{2}$ ozs. Dissolve the carmine in the ammonia, filtering if necessary. With this mix thoroughly an ounce and a half of the hot gelatine solution. To the remaining half ounce of gelatine add the acetic acid, and drop the mixture, little by little, into the solution of carmine, stirring briskly. This mass answers for balsam mounts, but not when glycerine is used.

G. R. I.—We would recommend Sternberg's work on the Bacteria as a book for general reference. For laboratory use, Crookshank's Practical Bacteriology is an excellent book.

W. J. J., COLUMBUS, O.—The formula for a glycerine-jelly is given on p. 152 of THE MICROSCOPE for this year. There are several other methods of preparing the jelly, but they do not essentially differ from this one, and are no better, if as good, for a mounting medium.

F. W. D., BATTLE CREEK, MICH.—We believe the last edition of Carpenter's work on the microscope was issued in 1881. If you have had no experience with the microscope we would advise you to invest first in Bausch's Manipulations of the Microscope, and then Manton's Beginnings with the Microscope, or James' Elementary Microscopical Technology. When you have exhausted these you will find Carpenter or Beal the best book for general use. THE MICROSCOPE will furnish you with much information which will not be found in the hand-books. We also give you the latest microscopical news.

J. D. B., LIBERTY, PA.—The cover-glasses which you boiled in lye are thereby rendered unfit for microscopical purposes. Alkalies have the power of eating or etching glass, which acids do not seem to possess. We would recommend that you use in future one of the many agents, preferably that recommended by Gage, for cleaning slips and covers.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be given ONE INSERTION FREE OF CHARGE. Dealers are referred to our advertising department.

WANTED—Standard books on Rotifera, Infusoria, Diatoms, Algæ, etc. Will exchange general scientific and literary works for the above.

JAMES E. WHITNEY, Rochester, N. Y.

FOR EXCHANGE OR SALE—Double-stained Bacillus Tuberculosis slides. Will exchange for histological or pathological mounts.

F. T. MERIWETHER, M. D., Asheville, North Carolina.

FOR EXCHANGE—I have for exchange for mounted slides, specimens of crystallized quartz, microscopic and small, perfect crystals, crystals from one-half to three inches in diameter, crystals containing floating particles, crystals containing cavities, and some containing hornblend. State which you prefer and I will endeavor to give satisfaction.

D. M. FULLER, 154 Hamilton St., Albany, N. Y.

QUEEN'S "Physiological" microscope, complete in case and in perfect condition, with one eye piece and 1-2 and 1-6 inch objectives and camera lucida. Will sell for \$30, or exchange for a high grade 1-2 or 4-10 inch objective—Gundlach or Bausch & Lomb preferred.

HORACE G. WETHERILL, M. D., Trenton, N. J.

WANTED—Copy of "Hogg on the Micro-cope," latest edition, for which I will exchange secondhand copy of Beale's "How to Work with the Microscope," in good condition. Address

W. T. COX, M. D., Groesbeck, Texas.

FOR SALE—A Tolles 1-10 glycerine im. 180°, a Wenhaus Reflex Illuminator, made by Mr. Tolles to use with the above lens, and a Fasoldt Micrometer, 1-5,000 to 1-120,000, all in fine condition and cheap. Best of reasons given for selling. Address

F. J. SCHAUFELBERGER, Hastings, Neb.

DR. JAMES E. REEVES, 2235 Chapline street, Wheeling, W. Va., will dispose of a few of his fine mounts of typhoid bacilli, grown on potato, 30th culture, etc.

WILL EXCHANGE slides of plants, bark, heart and tongue of swine, all double stained, for good histological slides double stained with sulph-indigotate soda and carmine. Satisfaction sure. Correspondence solicited.

J. D. BECK, Box 10, Liberty, Tioga Co., Pa.

WANTED—Injecting syringe, case of dissecting instruments, and a valentine knife; will give fine slides or cash.

HERBERT M. RICHARDS, Sadsburyville P. O., Chester Co., Pa.

I HAVE a very fine case for a microscope, 18 inches high and 8 inches square, inside. Would exchange for a first-class $\frac{1}{4}$ inch objective.

A. W., No. 42 Allen St., Jamestown, N. Y.

FOR SALE—Nacht microscope, manacular, slide carrier on stage, 4 objectives, Nos. 24, 1, 3 and 5, French; 2 eye pieces; bull's eye condenser; 24 objective makes an excellent illuminator; camera lucida; forceps; mahogany silk-lined lock case, slides, etc. Cost 625 fr. Price, net, \$75. Address

C. A. FERNALD, M. D., 1483 Washington St., Boston, Mass.

FOR SALE—A Beck Binocular Economic microscope, in perfect condition, with $1\frac{1}{2}$ inch object glasses, two pairs of eye-pieces, concave and plane mirrors, side condensing lens for illumination of opaque objects, movable glass stage, stage forceps, plies with ledge, in mahogany case, stand $15\frac{1}{2}$ in. high. Has been used about twenty times. A first-class instrument, cost \$95, will take \$80.

WANTED—A two-inch objective, C eye piece and polarizing apparatus, Bausch & Lomb preferred.

E. H. RICHARDS, Woburn, Mass.

WILL EXCHANGE fine mounts of gold, silver, copper or tin, or of crystals for plenicope, for good histological or botanical mounts.

H. M. HILL, 30 William St., Watertown, N. Y.

WANTED—A second-hand polariscope, Bausch & Lomb preferred. Also good slides or material for scientific Americans.

W. C. GORMAN, Waterford, Pa.

WANTED—Who has for sale, cheap, first-class $\frac{1}{4}$ inch objective, and glass stage and slide carrier, for stage $3\frac{1}{2}$ in. diameter, both Bausch & Lomb. Address

F. W. POINDEXTER, Jeffersonville, Ind.

URINARY CRYSTALS in exchange for same, also correspondence with others on unusual products of urine.

J. M. ADAMS, Watertown, N. Y.

WANTED—A Microtome with freezing apparatus, in good working order.

J. H. THOMPSON, 17 26th St., Kansas City, Mo.

EXCHANGE—Tegel (Fossil Deposit) from Brünn, Moravia, Austria, containing fine forms and Marine Diatoms. Samples of 50 Grammes will be sent to anyone. Wanted in exchange good American Diatomaceous material of all kinds: Preferred, fossil earth from Santa Monica, Santa Maria, Monterey, Cal., and Seaweeds or Seamud, with Marine Diatoms.

J. C. RIMBOCK, 14 Simmering-Wein, Vienna, Austria.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,

At 21 State Street, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 25 Washington Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. Box 583, Detroit, Mich.

No receipt will be sent for subscriptions received unless specially requested.

Specimens for examination should be sent to the *Microscope Laboratory*, 25 Washington Avenue, Detroit, Mich. In all cases the transportation charges on these specimens must be prepaid, and special directions for packing and shipping will gladly be sent upon application.

VOL. VII.

DETROIT, JULY, 1887.

No. 7

ORIGINAL COMMUNICATIONS.

THE MICROSCOPICAL STRUCTURE OF THE COTTON SEED,

AND OF THE COMMERCIAL PRODUCTS OBTAINED THEREFROM.

C. M. VORCE.

THE cotton plant, which is one of the most important productions of the United States, is of the natural order *Malvaceæ*, and genus *Gossypium*. Three species are recognized as being native to this country, viz: *G. Herbaceum*, the so-called "upland cotton," an annual; *G. hirsutum*, the shrub cotton, which produces several successive crops on the same plant, and *G. Arboreum*, the tree cotton, a perennial of tree form, reaching the height of twenty feet or more. The Sea Island cotton, *G. Barbadosensis*, is an introduced species said to be indistinguishable, botanically, from the East Indian cotton. Of the above species only the *G. herbaceum* and *G. Barbadosense* are cultivated in the United States, and the *G. herbaceum* is more extensively cultivated than all others combined, throughout the world. It was to the use of this species that the former boast of the Southern planters that "Cotton is King," was due. This saying was, for a long time, proverbial, but later it was admitted, even by the planters, that the sceptre of King Cotton had been wrested from him, and that, to whomsoever else it might belong, it would never be restored to or revested in cotton. Within a comparatively few years, however, events have so shaped themselves as to foreshadow the restoration of the royal purple to King Cotton, and these will be noticed in the conclusion of this paper.

Although the cotton plant is familiar to most citizens of the United States, a brief description may be tolerated in this connection. The *G. herbaceum* is an annual herb of a luxuriant growth on good soil, reaching the height of three to four feet, but usually varying from twenty inches to three feet in height, and spreading to cover about as much in width as its own height. It is no uncommon thing to see a field of cotton where the ground is completely hidden, the plants, set in rows about four feet apart, meeting between the rows and interlacing after the field is "laid by," in a single mass of verdure. The white, pink, or bluish blossoms are produced terminally on innumerable branches, as many as 500 blossoms having been counted on a single plant, and after fertilization are succeeded by the seed-pod, or "boll," $1\frac{1}{2}$ to $3\frac{1}{2}$ inches in length, ovate, and longitudinally ribbed, in which the seeds to the number of from twenty to sixty are produced, surrounded by a mass of fine filamentous cells, constituting the cotton fibre so well known in every quarter of the globe.

The seeds of the Sea Island cotton are black, elongated and almost free, the cotton adhering pappus-like to one end only. The seeds of the tree cotton are chocolate brown, pyriform, and entirely free from the fibre, which is shorter than that of the Sea Island, although the boll is much larger and longer. The seeds of the upland cotton are dark olive green, often nearly black, oval and densely clothed with the fibre, which, when the contents of the boll are removed in picking, almost conceals the seeds. In this condition it is known as "seed cotton," the seeds constituting about three-quarters of the total weight of the mass. By passing the seed cotton through a cotton gin the fibre, technically known as "lint," is in great part removed by the saws of the gin, leaving the seed, however, still covered all over with a short, downy remnant of the fibre or lint. It is in this condition that the cotton seed is sent to market by the planter, and the examination of the seed will therefore commence at this point, and will be limited to the upland cotton, *G. herbaceum*.

Plump, well ripened seeds average about seven to ten Mm. in length by about four to six Mm. in breadth, oval and covered with a matted lint about four to twelve inches long on well-ginned seed.

Figure 1, Seed. Figure 2, Lint.

The seed coat or "hull" is a dense, woody fibrous covering, about .3 Mm. thick, tightly investing the kernel, which also is of quite dense consistence. On first examining a radial section of the

hull it appears to be composed of three layers, but by softening the hull with potash and isolating its elements it is found to be composed of two layers of very different cells. The outer layer of the hull consists of densely packed columnar cells, irresistibly reminding one of the basaltic structure of the famous Giants' Causeway. These cells are disposed with their long axis radial to the meat and are of a different consistency at the two ends, so that when a radial section of the hull is viewed it is traversed by a dark line parallel with the outer surface and about one-third of the width of the section therefrom, giving the appearance of two layers of columnar cells, which is, however, shown to be illusory by the fact that the cells may be very readily separated from each other, and the isolated cells show the appearance noted to be due simply to difference in structure in the two parts of the cell.

Fig. 3, Section of Hull. 3a, Cells separated.

The inner layer of the hull, which separates readily from the outer layer, is composed of compressed cells, which, when softened, swell up into rudely cubical cells, three or four tiers of which compose the inner layer, and, being hard and woody, form a smooth inner surface to the shell.

Fig. 3b, Inner cells separated.

The cells of the outer layer are from .18 to .25 Mm. long by .03 Mm. in diameter; those of the inner layer are about .06 Mm. in the longer dimension.

The kernel of the seed, known in the trade as "meats," is composed of the intimately plicate cotyledons of the seed, enclosing the radicle, the whole enclosed in a membrane investing the kernel and forming a considerable part of the meal of the seed. This investing membrane is composed of two layers of small compressed cells, and is lined with an extremely thin membranous lining, which can be separated after boiling in acid, and then displays no distinct structure. The kernel proper, formed by the cotyledons and radicle, consists of compacted cells, interspersed among which are a multitude of minute, globular oleo-resin cells, or glands, commonly called "oil-cells," having a diameter of about .10 Mm., but variable in size.

Fig. 4, Section of Kernel. 4a, Oil-cells.

The cellular structure of the cotyledons consists of a superficial layer of cells regularly disposed in two tiers, with the parenchymal cells and oleo-resin glands filling the interspace. The

parenchymal cells are slightly smaller and more compacted around the oleo-resin cells, but do not differ otherwise from the remainder of the parenchyma.

Fig. 4b, Parenchymal Cells. 4c, Outer Layer of Cells.

The cells of the parenchyma do not ordinarily exhibit any formed starch, but the elements of starch are contained in the cells, for upon chemical analysis of the meal in quantity the presence of starch is indicated, and a fine granular matter with which the cells of the parenchyma are filled, shown in portions only of Fig. 4, is undoubtedly of an amylaceous character. Iodine does not give a distinct reaction, indicating starch.

Fig. 4d, Granules.

The oleo-resin glands, or cells, are composed of a thin-walled cell of structureless membrane, and are filled with a dark reddish oil, holding in solution a small percentage of resin and a minute quantity of an essential oil. The contents of these oleo-resin glands constitutes the cottonseed oil of commerce, a product which has caused as great a revolution in the oil trade as the fibre of the seed caused in that of textile fabrics, so that twice in the world's history its commerce has been fundamentally affected by the product of a single plant, whose product in each case supplanted those of a number of other sources of supply.

Microscopical examination of the oil itself reveals nothing, but the separated stearic matter which settles in the more viscous of the refined oils is found to be composed of fine acicular crystals, cohering in 'burr-like masses, very similar to but less dense than those of lard.

Fig. 5. Crystals.

The solid fatty acids of the oil resemble those of animal fats and are beautiful objects by polarized light, crystallizing in irregular plates, curiously interlaced and matted together.

The microscopical structure of the cotton fibre is so well known to all microscopists as to prohibit description here. The lint remaining on the seed after ginning is the remnant of the fibre and has the same structure. In the manufacture of the oil, the first process to which the cleaned seed is subjected to is "linting," which consists in passing it through a specially constructed saw gin, or "linter," by which almost all of the lint is removed, forming a short, staple, light lint fibre, called "re-gins," which forms a paper stock of the highest quality. A lower grade of paper stock is made from the hulls, which are easily reduced to fibre, and is

used in the production of coarse, cheap papers and flooring, building and mill-board papers. Intermediate grades, such as hardware and lining paper, etc., are made from a mixture of the lint and hull paper stocks, often with wood pulp and other well-known paper stocks.

Fig. 2 Lint. Fig. 3a, Hull Fibres.

In the cottonseed meal, which is simply the cake re-ground, all of the above-described elements of the structure of the seed, as would naturally be expected, are found. The cells of the cotyledon, of course, predominate, and the fragments of hull and lint are few, yet always present, as well as occasional detached oleo-resin cells.

DESCRIPTION OF PLATE.

Figure 1. Cottonseed, natural size, with and without lint.

Figure 2. Lint removed from ginned cottonseed. $\times 25$.

Figure 3. Hull of cottonseed, radial section, $\times 25$; (a) separated cells of outer layer of hull, $\times 60$; (b) cells of inner layer, $\times 60$; (c) tangential section of hull, $\times 250$; (d) separate cells, $\times 250$.

Figure 4. Transverse sections of cotyledon near end of seed; (a) oleo-resin cells, or glands; (b) cells of parenchyma, filled with granular matter (starch) $\times 250$; (c) cells of outer surface of cotyledon.

Figure 5. Crystals of cottonseed stearin, $\times 25$.

Figure 6. Crystals of fatty acid from cottonseed oil.

CLEVELAND, OHIO.

INSECT PREPARATIONS.

FIRST PAPER.

B. F. QUIMBY.

SOME preliminary suggestions may be of value as to collecting. Small wide-mouth bottles are most convenient. To avoid injury to their more delicate parts, put only a few insects in each bottle. If considerable time must elapse before preparation, gather them in a saturated solution of salt in water, which will preserve them a long time, with little depreciation in condition; but when used they should be immersed in fresh water for an hour or so, to remove the salt. It is better, however, to prepare the fresh insects; but many kinds will improve their conditions for the purpose by a few days' starvation. A wide-mouth bottle, with gauze secured over the opening, is a good receptacle for this purpose. The killing may be humanely done, as some atonement for the starving, by moisten-

ing the gauze with chloroform, covering it so that the fumes must enter the bottle. For the subsequent operations the following outfit will be required:

FLUIDS.—Alcohol, Canada balsam, chloroform, liquor potassæ, oil of cloves and distilled water. Absolute alcohol is the best, but is not so readily obtained, and in using will not long remain absolute. The ordinary 94 per cent. will serve. Canada balsam, prepared with chloroform, is the most suitable, as it does not require heat in use and hardens sooner. To prepare this, put the pure balsam in a low, broad bottle and cover the top with paper to exclude dust, then put the bottle in some warm place, avoiding much heat, which will discolor the balsam. When quite hard dissolve with chloroform, making it thin enough to filter. After filtering it will soon come, by evaporation, to a proper consistency, to maintain which will require that chloroform be occasionally added. A good method of keeping balsam is in one of the bottles described for the purpose in W. H. Walmsley & Co.'s catalogue.

In using balsam the writer has found no better way than with an ordinary medicine dropper, with bent point. Press the rubber top, and place the point in the balsam, which will fill the tube, when pressure is removed; the balsam may then be very delicately applied by slight pressure. After using, press out the balsam and put the dropper in place of the cork in an ordinary narrow-mouth ounce bottle containing turpentine. By this means the dropper remains clean. Press out the turpentine carefully before again using.

The liquor potassæ should be of officinal strength, viz.: 1 oz. (Troy) fused caustic potassa and 1 pint distilled water. The oil of cloves should be the best. When old it becomes too dark, and when colorless it is generally impure. The proper color is that of pale sherry. Distilled water is of course the best, but ordinary clear water will answer. All the fluids named should be filtered. If ordinary filter-paper is used, run the fluid through two or three times, or some of the fiber of the paper will be found in the result. Glass wool is a very good filtering material and is cheap. Crowd a wad of this into the tube of a small glass funnel and allow the fluid to filter through it.

Three glass jars, about four inches high, and holding about one-half pint each, are most suitable for holding the alcohol, turpentine, and water when in use in the process to be referred to. These should have close fitting stoppers to exclude dust, and in the case of alcohol, to avoid as much as possible the lowering of its proof. The

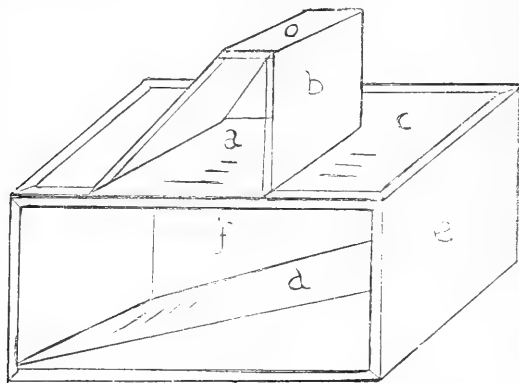
miniature section jars which are sold by druggists in sets of three, holding each about two fluid-ounces, will be found most convenient for many uses.

IMPLEMENTS.

A pair of very delicate tweezers, such as are sold for microscopical purposes. Four of the best red-sable brushes, with the hair about one-fourth inch long. Common camel-hair brushes do not serve so well, as they usually shed hair and are not stiff enough.

A fine needle, which has been heated in an alcohol flame, and hammered thin towards the pointed end, which should be rounded on a whetstone. Set this needle in the small end of a handle cut from one of the sable brushes, which are sold with handles twice as long as are needed for our purposes.

Some pieces of glass, which may be made by cutting in two the ordinary 3x1 inch slips.



The cut represents a sectional view of the mounting box: *e* is the box, $6\frac{1}{2} \times 6\frac{1}{2}$ inches, and $4\frac{1}{2}$ inches in height, constructed of rosewood; *b* is the cover, to which is attached *o*, the slide rest with centering spot. This is removable. Beneath is the ground glass plate *a*, *f*. At *d* is a mirror set at about 45 deg. angle, reflecting the light from the opening at its lowest end (the side is here wanting) up through *a* to *o*.

Clips made of spring-brass wire, a little over $\frac{1}{32}$ of an inch in diameter, which can easily be made with a pair of pliers. Equivalent clips may sometimes be bought of opticians.

The mounting and dissecting box, shown by cut herewith, is not an essential implement in the processes to be described, but is most convenient, and much better work may be done with it. With the top removed, it is, for dissecting purposes, or any microscopical preparation in which a strong light is desired—and by this device the light is obtained by reflection from the mirror inside, which illuminates the plate-glass, ground on the under side to prevent an

unpleasant glare to the eyes of the operator. A shallow glass dish containing the object of preparation is placed on the glass plate, and a very satisfactory under illumination is obtained. With the top restored to its position it is then used for mounting purposes, affording an under illuminated and raised rest for the slip on which the object may be better seen and manipulated. Its use will be further described with the processes as detailed.

Another device as a rest for the slip in mounting may be easily made. To the center of a piece of board 8x8 inches, glue flatwise a block $1 \times 1\frac{1}{2} \times 3\frac{1}{2}$ inches. Paste white paper on the top of the block. Then placing a glass slip on the paper, put six pins or short pieces of wire in the block about the slip, to keep it in place. The pins should not project more than $\frac{1}{32}$ of an inch. A ring as a guide to the center may be made by placing a nickel in proper position on the paper and marking round it with a pencil.

PREPARATION.

Place the object for a few minutes in alcohol, then transfer to the liquor potassæ contained in one of the miniature section jars, or in a shallow ointment jar. This is done to soften and bleach the hard and opaque parts of the insect. The time required will usually be about one week, though some more delicate kinds require only a few hours, and for these it will be best to reduce the strength of the solution. Some obstinate and dense specimens may require even a month in this process. When the liquor becomes much discolored, put the objects in a fresh supply.

It is best not to carry the softening and bleaching process any farther than is absolutely necessary, and this can only be learned by experience. The process at the best will often destroy the tracheal system of the insect, which is a most interesting part. It is better to depend upon the subsequent processes for the transparency desired. Some insects do not require the use of liquor potassæ.

In using the mounting and dissecting box, remove the top part and place a shallow glass dish, three or four inches in diameter, on the ground-glass plate. The glass dishes used for watch parts by watch-repairers are very convenient. Having water in the dish with pliers remove the insect from the liquor potassæ to the water. Adjust the box in relation to the light so that it may best under illuminate the object by reflection from the mirror within the box. All needed magnification of the object may be obtained by using a watch-maker's eye-glass. The kind having a spring to pass round

the back of the head, to hold the glass in position is best for the purpose. Having the insect first on its back under the water, take two of the small brushes, one in each hand, using one brush to hold the insect while with the other the wings, legs and antennæ are brushed out so as least to interfere with the process of removing the contents of the abdomen; which is done by gently pressing the body with the brush, to which is given a rolling movement, always in the direction from the head of the insect. Sometimes it may be necessary to make a small opening in the back of the insect near the extremity of the abdomen. On the thoroughness with which this cleansing is done will depend mainly the perfection of the mount. Have care in this process to avoid disturbing the wings and legs of the insect. The writer has sometimes used to advantage a hypodermic syringe, after cleansing as much as possible by the method stated. Filling the syringe with water, insert its point in the back of the insect and press the water slowly through the abdomen several times, thus washing out what previously could not be pressed out. Now float the insect on a slip of glass and procure fresh water, to which return the insect. Then brush carefully all the parts with an outward movement as to the body and in a direction from the head, and on both sides. In turning the object in the water, float it on a slip of glass and cover with another slip. This will prevent disturbing the position of the parts.

At last place the parts in the position desired, remove from the water and cover carefully with another slip. Then apply one of the brass spring-clips. By this device the insect is more evenly flattened by the constant pressure, and the spring is much more conveniently used than the fine wire sometimes recommended for fastening.

With some delicate objects the pressure of the spring may have too crushing an effect, to avoid which tie a piece of fine wire about each end of one of the slips of glass, thus preventing their approaching too closely. If the mounting and dissecting box is not used, the process of cleaning may be best done in a shallow white dish, with the most light possible to obtain in any ordinary way.

The insect remaining between the slips of glass is then to be immersed for a day or two in water. Then returning it to the water in the glass dish and removing it, under water, from the glass slips, carefully brush on both sides, for this is the final process in cleansing. Adjusting the parts and returning it to the slips of glass immerse in alcohol for one day, and then transfer to turpentine,

where it should remain several days, until all the appearance of water about the insect is removed. This may be facilitated by occasionally opening the slips of glass and brushing the object. The longer it remains in turpentine the more transparent it will become, and in that respect may go too far for the best effect. This process may be hastened, and to great advantage with many objects, by heating the turpentine during the operation, by placing a vessel containing the object in contact with a can filled with boiling water. For many purposes in microscopical work, a can one foot long, three inches thick and six inches wide, with its nozzle on one of its broad sides at the end, will be found useful in furnishing a moderately hot surface. In using, it may be placed on a small box with one end of the can projecting over an alcohol lamp, or Bunsen burner, by which the water in the can is heated. Care should be taken to cover the turpentine, to prevent its fumes from coming in contact with the flame. A tin cover of a candy-jar will serve. From the turpentine the insect, removed from the glass slips, should be put in oil of cloves, where it may remain for not less than one day, until wanted for mounting. Hardened by the alcohol, the parts will not readily change position with the exception of the membranous wings, which all through the process must be managed with great care.

The most delicate of insect wings will usually become so softened by the liquor potassæ as to resist the most careful endeavor at arrangement.

The principle involved, in passing the object through the various fluids, is that each is miscible with the succeeding one, and the last with Canada balsam, its final medium in mounting. The alcohol hardens the tissues, on which the oil of cloves and turpentine act as clearing agents, making the insect transparent by their high index of refraction.

CHICAGO, ILL.

THE MICROSCOPICAL EXAMINATION OF URINARY DEPOSITS.

SECOND PAPER.

C. G. JENNINGS, M. D.

Perfectly normal urine at the time of evacuation, and for a variable period after, is of such a chemical composition that all of its constituents are held in solution. After a few hours' exposure, however, microbes introduced from the air induce changes in composition which cause the precipitation of certain compounds.

The first change that is noted is an increase of acidity. This begins a short time after evacuation, and if the urine be kept in a cool place, continues for twenty-four hours or more. This is called the *acid fermentation*. The sediment examined during this period shows the special microbe that causes the fermentation. It is a minute spherical organism, occurring singly and in groups of two or more, arranged in chains or masses. It bears a close resemblance to the *torula cerevisiæ*. So far as I am aware, it has not yet been named. According to Scherer, this microbe and the bladder mucous decompose part of the urinary pigment into lactic and acetic acids. These acids decompose the soluble neutral urates—the form of combination in which uric acid occurs in the urine—and produce first, the sparingly soluble acid urates, and ultimately the almost insoluble uric acid.

During this fermentation, then, a sediment of urates and uric acid is a normal occurrence. A few crystals of calcium oxalate often are present. (Fig. 1.)

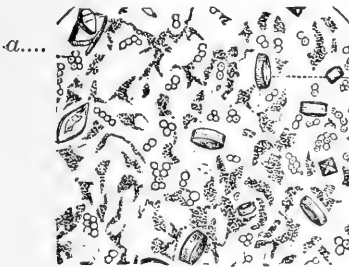


FIG. 1.

Deposit in "acid fermentation" of urine: *a*, fungus; *b*, amorphous sodium urate; *c*, uric acid; *d*, calcium oxalate.



FIG. 2.

Deposit in *ammoniacal* urine (alkaline fermentation): *a*, acid ammonium urate; *b*, ammonio-magnesium phosphate; *c*, putrefactive micro-organisms

The influence of this microbe in the production of the acid fermentation is not admitted by all observers. Brücke thinks the lactic acid is formed from minute traces of sugar in the urine, while according to Hofman, phosphoric acid and a basic salt are formed from the acid sodium phosphate.

Exposed a longer time, especially in a warm place, the urine becomes neutral, and finally strongly alkaline in reaction—it undergoes the *alkaline fermentation*.

This change is the result of the decomposition of the urea into carbon di-oxide and ammonia, induced by the development of the *Micrococcus ureæ* and the *Bacterium ureæ*. Every urine under-

going this change will be found to be swarming with these organisms. The experiments of Sternberg have proven that they are the cause of this change. He found that urine collected in sterilized vessels, and carefully protected from the invasion of microbes, remained perfectly fresh for indefinite periods.

The ammonia produced by the decomposition causes the precipitation of compounds which, while they remain in solution in normal acid urine, immediately precipitate and appear as a sediment when the urine becomes alkaline. The compounds insoluble in alkaline urine are calcium phosphate, amorphous or rarely crystalline, acid ammonium urate in spiculated spheres, and the large prismatic crystals of ammonio-magnesian phosphate. This last compound does not exist as such in urine, but is formed by the ammonia combining with the magnesium phosphate to form the double salt.

In determining the clinical signification of urinary deposits, the observer should always bear in mind the influence of these fermentations.

CLASSIFICATION OF DEPOSITS.

Urinary deposits may be classified as follows :

UNORGANIZED.

CRYSTALLINE.

Uric acid.
Calcium oxalate.
Cystin.
Hippuric acid.
Calcium phosphate.
Leucin.
Tyrosin.
Ammonio-magnesian phosphate.
Ammonium urate.

AMORPHOUS.

Urates { Sodium.
Potassium.
Calcium phosphate.
Calcium carbonate.
Fatty particles.
Molecular debris.

ORGANIZED.

MORE OR LESS ROUNDED IN FORM.

Blood Corpuscles.
Pus
Epithelial cells.
Spermatozoa.
Elements of morbid growths.
Spores and fungi.

CYLINDRICAL IN FORM.

Tube casts.
Bacteria.

FLAKES.

Fibrin clots.
Mucus.
Masses of bacteria.

PROCEEDINGS OF SOCIETIES.

WELLESLEY, MASS., MICROSCOPICAL AND SCIENTIFIC SOCIETY.

THE tenth anniversary of the organization of this society was marked on Saturday evening by a reception and scientific exhibit on the second-floor centre of the college building. Miss Drury, of Natick, (B. A. 1879), who was the first president of the society, and who has been one to continue her microscopical work to some purpose since, and has been, for several years, instructor in Microscopy at the Martha's Vineyard Summer Institute, contributed some 25 objects of her own preparation. The varieties of hydroids were mounted with excellent success by a process which might be well styled "killing them alive." The mounts of lasso cells of jelly fish and the sections of pollen, double stained, showing the coatings and contents, were among those which tested most the skill of the manipulator. Tables in the east center were devoted to work in botany by various students. These included photo-micrographic negatives taken from sections of pine needles. These sections are interesting as it has lately been discovered that the best characteristics for distinguishing species are found by the form and arrangement of the tissues within:—crystals, raphides and cystoliths; fresh water algæ; air channels in nymphæ; double stained sections; fruited fern fronds.

The exhibits in zoology in an adjoining room included circulation in frog, cilia in clam, hydræ, amœbæ, colonies of epistylis, mounts of hydroids, calcareous spicules of synapta and chirodota, slides showing interesting structures of many common insects. A large number of exquisite glass models belonging to this department were with the microscopic objects. Rock sections and sections of crystals were displayed under several polariscopes by members from the physical department. Also absorption spectra with the microspectroscope, several optical effects with concave and cylindrical mirrors, and interesting experiments with floating magnets. In an adjoining room lantern projections in insect anatomy, plant sections and animal histology were going on for an hour. Mr. Brown, of Natick, by request, exhibited some of his ingenious pasteboard slides, also some of the fine vegetable preparations of Mr. Peet, of Baltimore. The following is an abstract of the sketch of the ten years' work of the society prepared by Miss Whiting, who has been connected with it from the first.

Like most beginnings in Wellesley College, the beginning of this society can be traced to the fertile mind of Mr. Durant. It was his idea that among the educating influences in the college outside the class room work, there should be four societies: A missionary society, a musical society, a literary society and a scientific society.

The scientific society he thought should be a microscopical club, because the microscope is used in a wider range of departments of research than any other instrument. Botany, zoology, lithology, chemistry, all must call it to their aid. Physics must lend itself to its perfection, moreover a knowledge of the use of this instrument he felt would be invaluable in the school room and the home.

The Shakspeare society was started, but when he urged the second year of the college the formation of a microscopical club, it did not seem to most of us that the time was ripe for such a beginning. The departments of science were scarcely organized, there was not a compound microscope in the college, and not a student who knew anything of its use. The idea of a society of this sort, which should be largely educational, did not seem fitting. "Begin a society of students and develop into a society of investigators," he said, and at last his enthusiasm carried the day. A few of us were converts to his idea, and in the spring of 1877 the society was started with six members, and an exhibit under *three* microscopes at the first meeting. At that early day the laboratories for advanced work in the microscopical sciences were not yet opened, and a class in the manipulation of the microscope was at once started by the writer, and some practice each week was made the condition of membership. Mr. Durant was almost invariably present at the monthly meetings, and no apparatus or object which would give interest to them was denied us. Indeed he would often suggest that luxuries in the way of apparatus should be ordered, such as a 1-25 objective of Zeiss, a 1-16 of Powell and Leland, a 1-10 of Tolles, Binocular stands of Zentmayer and Beck, and valuable slides.

The first event in our history was a visit from the Boston Society of Microscopists in 1878. Some 30 gentlemen brought to us their own microscopes and work for an exhibit, we had then but *six* compound microscopes in the college. In 1879 we invited this organization, which, by the way, we have survived, to a return exhibit under *fifty* microscopes, consisting entirely of work done here. In 1881 we gave the second large exhibit under more than *ninety* microscopes.

In every detail of these meetings Mr. Durant was interested. Since then scientific study has become so well established in the college, and the departments have been so greatly enlarged and widely separated in different buildings that such extensive exhibits have not been undertaken. As the standard of membership has been raised, the papers which have been upon a wide range of topics, have increased in intrinsic value, and in the excellence of the individual work which has always been exhibited in connection. The society has come to furnish a means of exchange between the different departments, by which those devoting a large part of their time to one, could yet keep intelligent in others; moreover, by throwing its monthly meetings so often open, it has drawn into enthusiasm for scientific work those who have just entered college, after a long drill in mathematics and classics, and who have rarely been so fortunate as to have teachers who had opened their eyes to the beauties of nature.

The society has been favored with lectures by friends from without. The following is a partial list: Micro-lithology, by Mr. Dickerman, of Boston, illustrated with lantern projections of rock sections with polarized light; Inclusions in gems by Mrs. Chase, of Philadelphia, illustrated by a rare collection of gems which she brought on; Rulings on glass, by Prof. Rogers, illustrated with a collection of slides afterwards sent to the Royal Society of London. Dr. Wm. B. Carpenter, president of the Royal Society, was received in 1882 and spoke some inspiring words. Dr. Bolles, of Salem, has given two admirable lectures, finely illustrated. Dr. McCork, of Philadelphia, lectured on the Honey Ant of the Garden of the Gods. Mr. Elijah Edwards spoke on the Bee and its Habits, and placed an observation hive in one of our windows for study of the insects at work. Mr. Storrow Higginson has spoken three times before the society, once on Personal Recollections of Thoreau. Each time he has brought out his exquisite collections of lichens. Mr. A. B. Hervey, of Taunton, spoke on marine algæ with plentiful illustrations by charts and microscopes, and Prof. Wm. Davis, of Harvard, gave a most rare lecture on the causes of the red sunsets and sky colors in general, following a study in the society of sand and dust, volcanic, meteoric and cosmical. Dr. C. E. West, of Brooklyn, this year brought on some of the most valuable objects in his remarkable collections for our inspection, and gave from his own experience the history of microscopy in this country for fifty years.

Aside from the gifts of Mr. Durant and purchases, the collections have been enriched by generous friends. The first gift was from Mr. G. W. Corthell, of Boston, of double stained plant sections. He also gave a demonstration of his methods of staining and mounting. The society is further indebted to Mr. W. H. Walmsley, of Philadelphia, for slides and photographs; to Mr. T. D. King for slides of sections of pine needles, odontophores, etc.; to Dr. Thomas Taylor, of Washington, for specimens of crystals in fats; to Mr. W. H. Griffith, F. R. M. S., and Vice-President of the American Society of Microscopists, for a collection of slides of his own mounting, and through him to Dr. Duffield, of Detroit, for fine histological and pathological specimens, and to Mr. J. D. Walker, F. R. M. S., of Utica, for a number of his unsurpassed diatom mounts. Others have presented valuable slides in smaller number. The Society has had more than 140 different members, many of whom have purchased microscopes to continue their work after their college days, and we start out on a new decade with fresh courage, believing that the outcome has justified the novel experiment of a College Society of this sort, composed largely of students.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

A MEETING of this Society was held May 11, 1887, President Wickson occupying the chair.

The Secretary announced the receipt, from Dr. Thomas Taylor, Microscopist of the Department of Agriculture, Washington, D. C., of the last annual report of that department, accompanied by a number of colored plates, photo-engravings and photo-micrographs, illustrating the crystallography of butter, and of other animal fats. A great deal of work is now being done by Dr. Taylor in regard to this important subject, and his investigations, thus far, show that the fats of different animals differ in their crystallization. For example, if small quantities of butter, of lard and of beef-fat be separately boiled and slowly cooled for twenty-four hours, the resulting crystals will show very marked differences under the microscope. The normal butter crystal is large and globular, polarizes brilliantly and shows a well-marked St. Andrew's cross. That of lard shows a stellar form, while that of beef-fat has a foliated appearance. In course of time, as the butter loses its freshness, the globular crystals degenerate and gradually merge into peculiar rosette-like forms. The different stages of the crystallization could

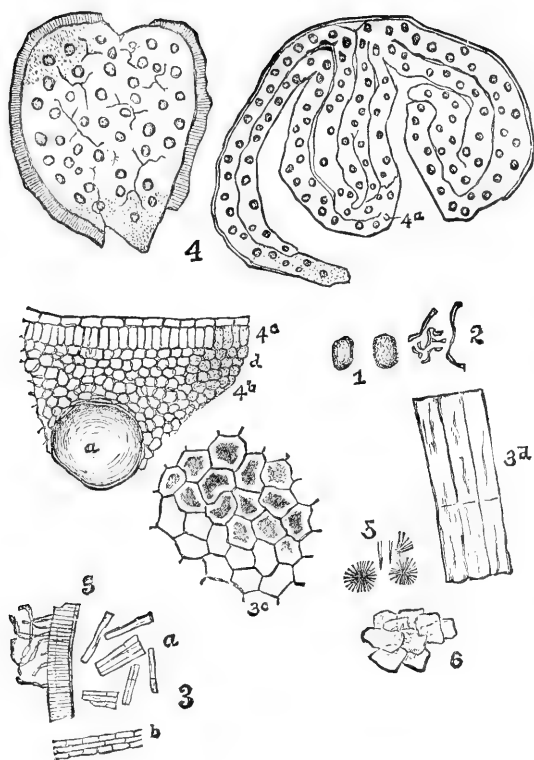


PLATE IV.

be plainly seen in the photographs sent. Specimens of butter-crystals had been prepared by the Secretary and were shown as resplendent objects under polarized light. Favorable comments were made on the excellent work done by this branch of the Government, in breaking up the traffic in unwholesome and fraudulent "butter compounds."

Specimens of the interesting little alga *Chlamydococcus pluvi-
alis* were sent in by Dr. H. W. Harkness. The bright-red globose cells bear a strong resemblance to those of *C. nivalis*—the microscopic plant producing the phenomenon known as "red-snow." A slide of the latter, gathered in the Sierra Nevada Mountains, near Donner Lake, was also exhibited to show the close similarity between the two plants. In fact, the later authorities are inclined to regard them as not specifically distinct, but differing only in habitat. *C. pluvi-
ialis* being the plant as found in rain-water, and *C. nivalis* as found in snow. The cells possess the remarkable property of retaining vitality after being kept dry for years, for as soon as moisture is supplied, vegetation again commences.

Communications were read, requesting exchanges of diatomaceæ, and of native gold crystals.

A committee, consisting of Prof. Hanks, Mr. Hyde and Col. Kinne, was appointed for the purpose of compiling and perpetuating the early history of the society.

Chas. C. Reidy exhibited a slide of Foraminifera under dark-field illumination, the latter being obtained in remarkable perfection by means of the Bausch and Lomb form of Abbè condenser.

A committee was appointed for the purpose of arranging details for the annual reception, to be held on the 28th inst., and the society adjourned for two weeks.

A. H. BRECHENFELD, *Secretary*.

BALTIMORE MICROSCOPICAL SOCIETY.

MEETING of May 16th, 1887, the President, Prof. G. L. Smith, A. M., in the chair.

OBJECTS EXHIBITED, BY THOS. COLEMAN.

(HISTOLOGICAL.)

1. Nuclei of the muscle fibre of the Necturus. (Lizard family, stained with gold-chloride.)
2. Small intestine of the rat (plexus of Meissner).
3. Small intestine of the rat (plexus of Auerbach).

4. Kidney of the cat (injected, showing blood supply).
5. Muscle of the cat (injected).
6. Villi of the small intestine of the cat (injected).
7. Human spinal cord (Weigert's method of staining.)

In the remarks upon the above specimens, presented by Mr. Coleman (of Augusta, Ga.), he was highly complimented for his work.

BY WM. B. CANFIELD, M. D.

8. Transverse section of an embryo pig (stained with eosin and hæmatoxylin).

9. Drinking-water (Baltimore, May 14th, 15th and 16th, 1887.)

The water contained a large number of diatoms, rotatoria and members of the cyclops family, beside a large amount of vegetable life in a state of decomposition. The City Water-Board say the reservoirs contain too many fish, thereby making the water bad to taste and smell.

10. Human skin (injected).

This specimen was obtained from an arm recently amputated. The injection was made with carmine gelatine, through the brachial artery, the skin then stripped from the arm and preserved as a whole. Pieces from this were imbedded and cut, so that the locality from which the specimen was taken was known.

BY G. L. SMITH.

11. Spirogyra in conjugation (mounted in glycerine jelly, showing it in all stages).

12. Aspergillus Glaucus—from plum jelly (mounted in glycerine jelly).

F. W. M'ALLISTER

Showed Holmans' "Life Slide" and "Current Slide," and also freezing gasoline microtome. He gave an interesting demonstration of them with remarks.

BY J. C. CULBRETH, A. M., M. D., PH. D.

13. Zygosporæ.

Dr. Culbreth gave at length a review of thallophytes, but confined himself mostly to zygosporæ, in which, for some time past, he had been specially interested. The characteristic differences between the myxomycetes and zygomycetes were illustrated by slides and by the fresh growing specimens. The former was shown to conjugate with motile cells, appears on stumps of trees, also on tan-heaps, is of a yellow color, and has the nomen, "Flowers of Tan," (*Ethalium septicum*.) In the latter, conjugation takes place be-

tween stationary cells. This appears on bread-fruit, glue, saccharine fluids, is often parasitical, and of a mouse color. The mycelium, *conidia* and *endogonidia* were all well brought out and elicited considerable interest. The family *mucorini* was well illustrated from both lemon and orange peel. Quantities of these fruits had been used in making juice for the soda fountain. After the rind had been pressed and strained from moisture it was heaped together in a moist and shaded exposure. Within five days the entire outside, and indeed nearly all the interstices of substrata, were thoroughly covered with the genus *Mucor mucedo*.

In remarks by members it was the general opinion that the microscope should be one of the important instruments of the druggist of the present and future, for drugs come into the market often so changed in form that with the eye the adulterations cannot be detected.

The Society adjourned to meet (according to the Constitution) in October.

ROBT. T. WILSON, M. D., *Secretary*.

THE New Britain, Conn., Scientific Association held its third annual soiree Wednesday evening, May 25th. Sixty-eight mounts were exhibited under twenty-five microscopes. The exhibition, which was largely attended, was followed by a reception.

ELEMENTARY DEPARTMENT.

FIFTH LESSON.

"CLEANLINESS IS AKIN TO GODLINESS."

INSTRUMENTS and material required.—1. A good section-knife. 2. A carpenter's glue-pot. 3. A large pipette. 4. One pound of paraffin-mass. 5. One ounce of ammonia-carmines. 6. Two ounces of xylol. 1. The section-knife possesses a rather long blade, flattened on the under surface and provided with a fixed handle. With practice, however, an ordinary razor of best quality will do all that is required. 4. Paraffin-mass is prepared by taking 14 ounces of the hardest and 2 ounces of the softer paraffin and melting together in the glue-pot over a water-bath. Stir constantly that they be thoroughly mixed. This mass will prove to be of about the right consistency. The hardness will vary somewhat with the temperature of the room. If softer mass is desired it can be made by varying

the proportions. Cocoa butter and vaseline cannot be recommended as a paraffin softener. 5. The formula for ammonia-carmines is: Take one part, by weight, of the best "No. 40" carmine, dissolve in 100 parts of distilled water, and then add one part of aqua ammoniæ. Expose the fluid in a shallow dish, and protected from the entrance of dirt, till the odor of ammonia is no longer or hardly perceptible.

SECTION-CUTTING AND STAINING.

In this lesson the art of making free-hand sections will be discussed, though at the present day microtomes or section-making machines are so perfected and sold at a price within the reach of nearly every worker in microscopy, that the art is fast becoming obsolete. They, however, who have only worked with an improved microtome would be surprised to see the perfection attained by an experienced free-hand cutter. The writer has in his possession a collection of specimens cut in this primitive way some years ago in a German laboratory; and though at the time no expert, he does not consider them so very crude when placed by the side of work done at a later day, and with the most helpful appliances. They who can afford it should, by all means, own a microtome, though such an instrument is not absolutely essential to the performance of good work.

IMBEDDING.—In order that the specimen to be cut be evenly compressed and, at the same time, firmly held, it is imbedded in some substance which is itself easily cut. Paraffin is generally used for this purpose. If the specimen be of delicate character or filled with cavities it should, before imbedding, be thoroughly permeated with the paraffin. To do this, place it—after hardening in alcohol—in a large volume of chloroform and leave for twenty-four hours. Now melt the paraffin-mass over the water-bath, and immerse the specimen in it, where it should remain for two hours, when, on removing and cooling, it will be found quite firm. Care should be taken that the paraffin be kept only at the melting point, for if it be allowed to boil the specimen will be ruined. Objects of firm texture such as liver, kidney, etc., do not need this preliminary treatment.

Of thin cardboard make a box about two inches in length and one inch in width and depth. A pill-box of similar dimensions or a Swedish match-box will also answer admirably. After melting the paraffin-mass fill the pipette with it, and cover the box-bottom to a depth of about three-eighths inch. Now take a piece of the hardened

cat's-lung about one-half inch long, three-eighth inch wide and one-quarter inch thick, with a portion of the capsule running lengthwise, and drain off the superfluous alcohol by means of a blotter. By this time a film sufficiently strong to just bear the weight of the specimen will have formed on the surface of the mass in the box. With a pair of forceps grasp the specimen and carefully place it lengthwise on this film with the end from which the sections are to be made about three-eighth inch from the end of the box. Now from the pipette slowly run in sufficient of the mass to fill the box. This mass should be hot enough to melt the surface of the film; yet, on the other hand, not so hot as to dissolve it altogether, thus allowing the object to fall to the bottom. With a little practice this can be easily performed. When the mass has hardened thoroughly, it can be removed from the box and is ready for immediate work, or it can be labeled and laid away for use in the future.

For cutting, see that the section-knife or razor is in good condition. Fill two dishes each with stronger alcohol. With a pocket-knife carefully pare away the superfluous paraffin from the edges and end of the block. In doing this, care should be taken not to expose the specimen, for the dull blade will catch and disarrange it. Now rest the lower end of the block on the table and grasp firmly with one hand. Dip the knife in the alcohol so that the upper concave surface will be filled with it. [Note: In cutting, keep this concavity CONTINUALLY filled, for if the blade become even partially dry it will almost certainly tear the specimen.] Now cut successive thin sections from the paraffin-cover, and keep on till the specimen is reached and a sufficient number of sections are obtained from it. The knife must be managed in the following manner: Begin at the heel of the blade and cut by drawing through the specimen. Do not push the blade into the object nor saw it to and fro. Make the section with one slow sweep so that when separated it will glide on to the blade near the tip. It can then be floated off into the extra dish with a gentle urging from a camel's hair brush.

If it is desired to cut more sections from this specimen at another time, the block must now be put in alcohol, as the uncovered object would otherwise shrivel and become useless.

The specimen is now to be treated as follows: Handling it by use of paraffin, or tissue-paper, as described in the last lesson (page 174,) it is to be removed from the stronger alcohol and exposed for a few minutes until comparatively dry. Place it in a liberal quantity of xylol and leave for about an hour. This is for the purpose of

removing the paraffin. Transfer it back to the alcohol for five minutes to clean out the xylol, and then wash gently in distilled water. With ammonia-carminé fill a salt-cellar about one-quarter full and immerse the carefully-flattened specimen in it. About five minutes is consumed in the staining, after which the specimen is again washed in distilled water to which a few drops of acetic acid have been added. The acid acts as a mordant, fixing the dye in the nuclei. Now transfer to the strongest alcohol to remove the water, then to turpentine or clove-oil, and finally to Canada-balsam, as described in the previous lesson.

MICROTOMES.

A few words on this subject may not be amiss here. A very simple microtome, used to some extent by the writer, is the "New Model," manufactured by Jas. W. Queen & Co., of Philadelphia. A description of this instrument will be found in the January number of this Journal. One made by Schanze, of Leipzig, has proved extremely useful, specimens being cut with great rapidity and exactness. Specimens do not generally require imbedding when used on this instrument. Bausch & Lomb, of Rochester, N. Y., and W. H. Bullock, of Chicago, make a microtome after the Schanze model, to which they have added some improvements. W. H. Walmsley & Co., Philadelphia, make a modification of Rivet's microtome. The specimen is fed to the knife by means of an inclined plane, as in the Thoma instrument, thus securing great accuracy. The Thoma microtome, which is one of the best in the market, is manufactured in this country by the Educational Supply Company, of Boston. Attention is also called to the new Ryder microtome, described in our last number, which bids fair to become one of the most useful of this class of instruments. The prices of these various instruments range from \$12.00 to \$50.00.

EDITORIAL.

SOME RECENT ADVANCES IN BACTERIOLOGY.

So great is the interest in this fundamental branch of medicine, and so large has become its current literature that a weekly journal devoted exclusively to bacteriology is necessary to satisfy its devotees and record their researches.

The journal will be known as the *Centralblatt für Bacteriologie und Parazitenkunde*. It is published in Jena, and edited by Dr.

Uhlworm, of Cassel, Prof. Teuckart, of Leipsig, and Dr. Löffler, of Berlin. These names suffice to establish the character of the journal.

Many medical schools also have recognized the demand of students for the practical study of bacteriology and have established well equipped laboratories and appointed teachers.

The apparatus necessary to pursue the study is elaborate, and the optician is put to his best to produce condensers and objectives of the high power and quality demanded. There is no field in microscopy which offers such a rich harvest in all departments of the science as bacteriology. The cultivation, isolation, staining and mounting of microbes, demand the most delicate and skillful technique, while their study with the microscope requires lenses of the highest quality and the most exact manipulation of condensers and other necessary apparatus. This branch of microscopy then, offers to the expert opportunities for the display of his highest skill, and we commend it in strictly scientific sense to all workers in and out of the medical profession. The sanitary questions involved in the discovery of bacteria and the study of their life histories are of such import to the human race that unless some future discovery overthrows the present idea of their etiological significance, the study of microbes will hold for some years to come the first place in microscopical science.

Among the recent original studies in bacteriology are two which are of great importance to preventive medicine. Dr. T. Mitchell Prudden publishes in the *Medical Record* of March 26 and April 2, an exhaustive study of bacteria in ice, and the destructive influence of cold upon these organisms. The article details a new method of water analysis. In examinations of potable water it has been customary to depend upon chemical analysis to determine their probable salubrity, and much time and skill have been employed in perfecting the delicate tests. The presence of organic matter has been looked upon as indicative of the presence of specific poisons dangerous to health, but chemical analysis can determine only inferentially the presence of microbes. With the new method of analysis it is, as Dr. Prudden says, "no longer necessary to *infer* the presence of bacteria in a given sample of drinking water from its organic contents, but the bacteria may be actually seen, counted, and their species and actions on the animal body definitely determined. The new method of water analysis, by which its living bacterial contaminations are determined and studied, is called the *biological analysis*."

In another column is given the details of this method. We quote some of the conclusions arrived at by the experimenters :

"We are enabled to detect with great certainty the presence of bacteria, some species of which can give rise to serious disease, and that the chemical analysis alone does not suffice in cases in which such organisms may be present."

"The popular impression that water purifies itself in freezing is only partly true. While some gross particles, and to a certain extent materials in solution may be largely removed, the bacteria which are the most important, if not the sole agents in water deleterious to health, are only in part destroyed by the act of freezing."

"Different species of bacteria possess differing degrees of vulnerability to the action of low temperatures; in some species nearly all the individuals are killed by prolonged freezing in water, while in other species a small proportion only is destroyed, and between these extremes are other species possessing intermediate degrees of resisting power."

"Certain species of bacteria which are capable of producing serious and even fatal diseases in man—the bacillus of typhoid fever and the common bacterium of suppuration—are capable of resisting a prolonged exposure to a low temperature with the destruction of a part only of the individuals thus exposed."

Of equal interest and importance to the above is a series of experiments by Dr. Sternberg, intended to fix in a definite way the exact degree of heat which is required to destroy each of the pathogenic micro-organism at present known. The practical value of such knowledge in disinfection after acute specific diseases can be readily appreciated. The experiments have been published only so far as they relate to the typhoid bacillus. From these experiments Dr. Sternberg has determined that the thermal death point of the typhoid bacillus is 56° C. (132. 8°F.) We shall await with interest the further publication of his observations.

Mr. Arthur J. Doherty, of Manchester, England, to whose work we have already referred, is shortly to pass through the United States on his way to Australia. During his tour Mr. Doherty proposes to give a series of practical demonstrations before microscopical societies. The following list of subjects have been selected for this purpose : Animal and plant-section cutting : Single and double staining ; Anatomical injecting ; Selecting and arranging Foraminifera ; Mounting in balsam and other media and without pressure ;

The mechanical and optical construction of the lantern microscope, including an exhibition of a number of beautiful objects by means of this instrument.

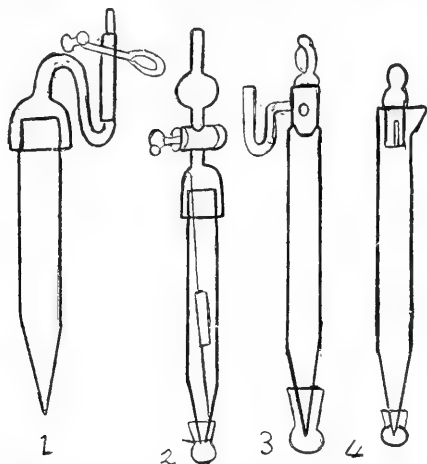
Mr. Doherty's long experience and well-known skill in practical and theoretical microscopy need not here be referred to. We hope that secretaries of Societies will avail themselves of this opportunity and communicate at once with Mr. Doherty, at 19 Blossom Ave., Manchester, England. A small fee will be charged for these demonstrations.

ACKNOWLEDGMENTS.—From the Palmer Slide Co., Smith's High Refractive Mounting Medium, index 1.8, of which we shall have more to say at some future time; from Dr. Geo. H. Taylor, Mobile, Ala., cleaned Pensacola Bay diatoms; from Mr. B. F. Quimby, Chicago, Ill., a mounting box, the utility and beauty of which merit and will receive a careful description.

TECHNOLOGY.

IMPROVED SETTLING TUBE FOR URINARY DEPOSITS.

Mr. F. Vanderpoel contributes to the *American Monthly Microscopical Journal*, a description of a device which will be found useful to the general microscopist as well as physicians.



The first two of the figures, 1 and 2, represent the tube as originally devised; 1 denoting the tube with movable cap secured to it by means of a rubber band, and 2 the tube with a ground-glass cap and stop-cock. The first departure from these forms is shown

at 3, and consists of a conical tube, as before, but provided with a perforated stopper, the side opening in which communicates with a side tube. The perforation in the stopper, which is easily made by a glass-blower, thus allows the overflow, when the stopper is inserted into the full tube, to pass into the side tube. The stopper is then turned so as to cut off the urine in the latter from that in the large tube, and the latter is thus made tight. After allowing it to remain at rest long enough to permit subsidence of all that will settle, the stopper is gently turned and a drop taken off the lower end upon a slide, to be examined at leisure with the microscope. The cap, ground and fitted upon the lower end, is put there as a precautionary measure, as will be seen farther on.

The tube shown at 4 is, we think, an improvement upon all of the foregoing, for upon it there is no side tube to break off, and everything is comprised in a small space. As will be seen by referring to the figure, there is a slight enlargement in the ground portion of the stopper-end of the tube, this protuberance coming down about one-half the length of the stopper, which is solid, and ground to fit perfectly. The lower half, however, is provided with a small, longitudinal slit or groove, the lower end of which communicates with the interior of the tube, whilst the upper end just reaches the enlargement in the side of the latter. Thus, in one position of the stopper, there is a communication between the tube and the outer air, whilst in all the other positions the tube is quite shut. In all these tubes care must be taken to fill them *completely* with the urine, and to allow no bubbles of air to remain therein.

The first of these settling tubes was made without the ground cap on the lower end, the latter being inserted into a small test-tube for safety. At the suggestion of Mr. J. L. Smith, the test-tube was made a part of the apparatus by fitting it (by grinding) upon the conical end, and in its present form it serves to protect the latter from dust and to prevent evaporation of the urine (or other liquid) and consequent deposition of salts, if, for any reason, the user should allow the tube to remain suspended for several days.

These tubes will be found very useful for collecting and concentrating into a small bulk the sediment contained in any liquid, whether it be composed of urinary deposits, diatoms in process of being cleaned, or anything of like nature; and as the parts are all of glass, the strongest acids may be used, excepting, of course, hydro-fluoric acid, without harm to the tubes.

ABSTRACTS.

THE BIOLOGICAL ANALYSIS OF WATER.

In his article on Bacteria in Ice in the *Medical Record* of March 28, Dr. T. Mitchell Prudden, gives the following method for the biological analysis of water :

In the first place, all the vessels and instruments which will come in contact with our water, and the food which we prepare for the nourishment of the bacteria are completely freed from all living germs, which are almost omnipresent in the air and on the things we touch. This is usually done by prolonged heating or steaming. Thus freed from all living things, no matter how small, our materials are said to be sterilized. The food which we prepare for the bacteria in water-analysis is usually beef-tea, with a little peptone and common salt and enough gelatin to make it moderately solid when cold. This is called the nutrient gelatin, or culture-medium and it is poured into test-tubes—a few teaspoonfuls in each. In this medium most of the bacteria which are commonly found in water will readily grow. It is clear and transparent and usually slightly yellowish in color. Now, one of the prominent characteristics of these lowly organisms, the bacteria, is their capacity under favorable conditions of nutriment and temperature, of rapid and enormous increase in numbers. This occurs by the slight enlargement of the individual bacteria and their division across the middle into two. These two then each again divide, and so on until within a short time an almost innumerable number of new individuals are produced from the original germ, each one the exact counterpart of its ancestors.

It is estimated that if the conditions are favorable, a single bacterium, by this process of growth and subdivision, may give rise to more than sixteen and a half millions of similar organism within twenty-four hours. But so minute are most of these that at an average estimate the whole of these sixteen and a half millions would occupy a space less than the sixteen-hundredth of a cubic inch. When a water analysis is to be made, the nutrient gelatin in one of the tubes is melted by gentle heat and thoroughly mixed by shaking with a measured quality of the water to be examined. In this way the bacteria contained in the water, always an unknown quantity and of course quite invisible, are evenly distributed through the gelatin. To insure accuracy, duplicate analyses are always made. The quantity of water used is usually one cubic centimetre, and this is taken

as the standard quantity in which the bacterial content is expressed. It should be remembered, in studying the results of the analysis which are to follow, that one cubic centimetre (i. c. c.) of water is a little less than one-third of a teaspoonful.

The portion of gelatin mixed with the measured quantity of water is now poured out into a sterilized glass plate, and is spread upon it in a thin, even layer. The plate, while this is being done, rests upon a level surface kept cool by ice, so that the gelatin soon solidifies. The plate with its gelatin layer is now put into a clean glass saucer, covered so as to be free from dust, and set away in a moderately warm place. Now, the single bacteria which are evenly distributed through the gelatin, commence to grow, but as they are each inclosed by a solid wall of the nutrient gelatin they grow in a little heap or mass, which is called a "colony."

In the course of from two or four days these colonies, each now containing thousands of individual bacteria, have grown large enough to be readily visible to the naked eye, or with the aid of a low power magnifying glass. We have now only to count these colonies and we know exactly how many living bacteria were present in the one cubic centimetre of water used for analysis, because each visible colony is the result of the growth on the spot of a single invisible bacterium which was caught here by the solidifying gelatin.

Of course, if two or more bacteria chance to have clung together when the water was mixed with the nutrient gelatin, our estimate of the number of original germs will be too low, but if the mixture was carefully made this so seldom occurs that the experimental error is slight. To facilitate the counting of the colonies, a glass plate ruled off into equal squares is usually placed over the gelatin film so as not to touch it, and thus if we do not count all the colonies, we can count those found in several of the squares, and then by multiplying the average number under the squares which are counted by the whole number of squares, we find the number of colonies, which is the same as the number of living bacteria in the volume of water analyzed.

If we wish to study these bacteria further, which is sometimes of the utmost importance, so as to identify their species, study their effects on animals and find out whether or not they are disease producing, or pathogenic, we put the glass plate under the microscope, and with a fine, sterilized platinum wire set in a glass handle, we take out a minute portion from one of the colonies and put it into a fresh tube nutrient gelatin, where it will grow until a sufficient quantity of the material is produced for experimentation.

Thus, no matter how many different species of bacteria were growing side by side on the gelatin plate, we can take out under the microscope a little of each by itself and transfer to separate tubes, and thus get what are called "pure cultures" of all the separate species.

NEWS AND NOTES.

PROFESSOR MÖBIUS, of Kiel, is the new director of the zoölogical museum at Berlin.

DR. NATHANIEL LIEBER-KUHN, son of the discoverer of Lieber-Kühn's glands, is dead at Marburg,

A NEW microscopical test for sugar in the tissues described by Molisch, consists in treating the alcoholic specimen with thymol and then an excess of sulphuric acid conc., a beautiful carmine red color resulting.—*Pacific Record*.

MR. S. E. CASSINO, Boston, Mass., announces a new edition of the Naturalists' Directory, to appear in January, 1888. All who are interested in any department of natural science should send their names to him for insertion in this work.

THE *Swiss Cross* continues to grow better with each issue. We congratulate the budding scientists of the land in having so able and instructive an organ. The papers on photography by Mrs. Laura M. Marquand are particularly interesting and valuable.

A. J. BROWN declares that the membrane commonly known as "mother of vinegar" is formed by *Bacterium xylinum* n. sp., and not by *B. aceti*, to which it has been ascribed. The membrane gives all the reactions of cellulose, which the bacterium forms from the dextrose and other sugars present.—*Botanic Gazette*.

DRS. HEITZMANN and Bödecker continue their valuable "Contributions to the history and development of the teeth," in the *Independent Practitioner*. The article for June contains several illustrations of the histology of the foetal tooth.

THIS is what the microscopist says he does when he drinks water from the lea: He gulps down infusoriæ, and quarts of raw bacteria, and hideous rotatoriæ, and wriggling polygastricæ, and slimy diatomaceæ, and hard-shelled ophryocercinæ, and double-barrelled kolpodæ, non-loricated ambædæ, and various animalculæ, of middle, high, and low degree, for nature just beats all creation, in multiplied adulteration.—*Medical Age*.

BOOK REVIEWS.

PRIZE ESSAYS OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, Second Edition, cloth, pp. 198 ; price \$1.00.

These essays are the outcome of prizes offered by Mr. Henry Lomb, of Rochester, N. Y., through the American Health Association. The motive that led to the offer of the prizes was the desire to obtain the best views on several subjects pertaining to public health and hygiene, so written that they would gain the interest of the public at large, and thus encourage a better knowledge of and wider interest in the prophylaxis of disease. The subjects have been singularly well chosen and are, with their writers, as follows:

I. "Healthy Homes and Food for the Working Classes," by Victor C. Vaughn, M.D., Ph. D., Professor in University of Michigan.

II. "The Sanitary Conditions and Necessities of School-Houses and School-Life," by D. F. Lincoln, M.D., Boston, Mass.

III. "Disinfection and Individual Prophylaxis Against Infectious Diseases," by George M. Sternberg, Major and Surgeon U. S. Army.

IV. "Preventable Causes of Diseases, Injury and Death in American Manufactories and Workshops, and the best Means and Appliances for Preventing and Avoiding them," by George H. Ireland, Springfield, Mass.

In the introduction we read: "That these essays may be placed in the hands of every family in the country is the earnest desire of the Association, as well as the heartfelt wish of the public-spirited and philanthropic citizen whose unpretentious generosity and unselfish devotion to the interests of humanity have given us these essays ; but the financial inability of the Association renders it impossible to distribute them gratuitously, therefore a price covering the cost has been placed upon these publications."

This work should be in the hands of everyone interested in public health and hygiene. The four essays can be purchased in pamphlet form for 30 cents, or in a neatly bound volume for \$1.00 or 65 cents.

SOME NEW AND RARE DIATOMS BY WALKER AND CHASE, Series II. and III. Price \$1.00.

These series consist of three plates, each containing a number of well-defined examples of new and rare diatoms from a collection of Barbadoes fossil marine deposits. Each is described in the accompanying text, and together make a fasciculus of much value

to the botanist. It can be obtained from either of the publishers, Dr. H. H. Chase, Linden, Mich., and W. C. Walker, F. R. M. S., Utica, N. Y.

ELEMENTS OF BOTANY, INCLUDING ORGANOGRAPHY, VEGETABLE HISTOLOGY, VEGETABLE PHYSIOLOGY AND VEGETABLE TAXONOMY, AND A GLOSSARY OF BOTANICAL TERMS; ILLUSTRATED BY NEARLY FIVE HUNDRED ENGRAVINGS FROM DRAWINGS BY THE AUTHOR. By Edson S. Bastin, A. M., F. R. M. S., Professor of Botany, Materia Medica and Microscopy in the Chicago College of Pharmacy. Cloth, Octavo, 300 pages; price, \$2.50. Chicago: G. P. Englehard & Company, 1887.

Prof. Bastin's book is intended to fill an intermediate place between the manuals for beginners and the higher hand-books of botany for advanced pupils, so that "any student of fair intelligence may take it up and pursue it (botany) without the aid of a teacher, and obtain a good foundation knowledge of the facts and principles of the science." The four departments into which the book is divided are handled in a thoroughly comprehensive and scientific manner, and in language as untechnical as is consistent with the subject. Part II., on Vegetable Histology, is particularly good, and the appendix treating of the microscope, accessories, staining and mounting, fluids, and micro-reagents, although not exhaustive, is sufficiently explicit to enable the reader to undertake independent study. The author has adopted the excellent plan of closing each chapter in the first three parts with a practical exercise, so that the student can work out for himself what has been taught in the preceding pages.

On the whole, Professor Bastin's book is eminently satisfactory—indeed, the best book on botany for high schools and colleges yet published—and will be greatly appreciated by teachers in medical and pharmaceutical schools, to whom we most cordially recommend it.

CORRESPONDENCE AND QUERIES.

PACIFIC HOUSE, ST. JOSEPH, MO., JUNE 18, 1887.

To the Editor of the Microscope.

I have never known better prospects for a grand meeting of the American Society of Microscopists than for the Pittsburg Convention next August. From all points of the compass microscopists and their friends say *we shall be there* unless something more than ordinary prevents. The working session this year will be a grand success. It is in the hands of a committee who will make it much better than ever before, and no one who can possibly attend can afford to be absent.

E. H. G.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be given ONE INSERTION FREE OF CHARGE. Dealers are referred to our advertising department.

FOR SALE OR EXCHANGE—A first-class Tolle's dry, $\frac{1}{4}$ in. 100° in perfect condition. Price, \$25. C. L. PETICOLAS, 635 Eighth St. N., Richmond, Va.

FOR SALE—One copy Van Heurck's Synopsis Diatoms, Plates bound, best library, text unbound, in perfect order. Price \$40. Also 1-10 objective, Homo, im. 125 balsam angle, made by Herbert R. Spencer in 1883. Cost \$80, will sell for \$55. Perfect order, used very little. Address H. F. DOUGLAS, Fenton, Mich.

FOR SALE—A Bausch & Lomb Investigator Microscope complete, with improved glass stage and slide-carrier extra. Cost \$75 only a few months ago, has not been used a dozen times; is perfect in every particular. Will sell for 20 per cent. less than cost. Correspondence solicited. G. H. BRICKETT, M. D., Augusta, Me.

GOOD MOUNTS—Vegetal and various, for a simple section cutter. A. E. WARREN, Rio Vista, Va.

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THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,

At 32, 34 and 36 Seitz Block, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 25 Washington Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. Box 583, Detroit, Mich.

No receipt will be sent for subscriptions received unless specially requested.

Specimens for examination should be sent to the *Microscope Laboratory*, 25 Washington Avenue, Detroit, Mich. In all cases the transportation charges on these specimens must be prepaid, and special directions for packing and shipping will gladly be sent upon application.

VOL. VII.

DETROIT, AUGUST, 1887.

No. 8

ORIGINAL COMMUNICATIONS.

NOTICE OF SOME FRESH-WATER INFUSORIA, WITH REMARKS ON COLLECTING AND PRESERVING THESE DELICATE ANIMALS.

D. S. KELLICOTT.

I MAY not be able to say anything that will aid those beginning the fascinating study of the Infusoria, or other forms of microscopic life; I am sure I can say nothing that has not been said regarding the matter of collecting, studying and preserving these delicate and minute creatures. But the readers of THE MICROSCOPE may not be familiar with what has been put forth for their help; again my methods and apparatus must present some points of difference from those of others, and, on this account, may possess some interest to those for whom these notes are written.

Where do the Infusoria abound? In the running, limpid streams; in the weed-grown, stagnant and forbidding pond; in springs, wells, and the clear waters of our lakes, both at the surface and far below it; and parasitically or as commensals they accompany numerous higher animals. Hence, they should be sought for wherever moisture is to be found. They occur free-swimming or attached to various objects, for example, the dissected leaves of water-plants, like the bladderworts, hornwort, water-star wort, water-milfoil, and various mosses and algae. Many forms prefer animal hosts; these may be found as ectoparasites of *Hydra*, fishes, newts, etc., while many more elect the gills and swimming feet of the cray-fish, or

fresh-water lobster, the gills and skin of the numerous species of mollusks, the blood and intestinal tract of frogs, newts, snakes, insect larvæ, and many other well-known hosts. An examination of the intestines of the earth-worm, the intestines and surface of aquatic worms, and the stomachs of ruminating herbivores will disclose many forms—some among the most remarkable and striking. The minute Crustacea abounding in every collection of fresh-water are favorite hosts of the Infusoria.

Now that a partial indication of where to look for our objects has been given, let us inquire when may they be found? Practically, the year round. Of course they are in greater abundance throughout the summer season than in winter, when the ponds and streams are mantled with ice, and the water beneath is at best but little above freezing temperature; still, in mid-winter, when the naturalist usually suspends field-work, many species may be taken from under the ice.

It seems hardly necessary to take much space in describing the apparatus and manner of using it; so, briefly, I have found the following contrivances handy: a minnow-net on a stout pole six or eight feet long—this will bring out of moderately deep water crays, larvæ, small fish, weeds, etc.; a drag, consisting of a lead of five to eight pounds weight with stout copper-wire hooks—this may be thrown out many feet from shore, or used in deep water for hauling in aquatic plants; a tow-net of silk-mull for skimming the surface; a small water-net for general use in concentrating the catch. The modification that suits me best is the usual conical form made of mull, with a short piece of $\frac{5}{8}$ or $\frac{3}{4}$ inch rubber-tubing, kept open at the upper end by a piece of stout glass-tubing bound into the apex of the net; when in use, the tube may be closed by a cork or have a wide-mouthed tube-vial inserted, the bottom of which has been removed and a net of mull tied over it. The usefulness of this vial into which the captured forms soon descend and are so readily removed to convenient receptacle, is obvious. Another useful piece is the dipping-bottle; this and the small net may be made to work at the end of a common cane; a longer stick will be found convenient often, but by using a plain walking-stick one avoids the curious and the "crank" who always wants to know how the fish bite, or what you are fishing for, particularly if he sees you about some muddy puddle, how provoking to a sensitive nature! I would advise the collector to use plenty of wide-mouthed bottles for carrying what

is taken, not to put too much into each one; keep the various collections separate, and on reaching home remove them to shallow dishes, exposing much surface to light and air.

The above mentioned tools, together with a growing experience and a firm determination, will enable one to capture Infusoria in variety and abundance. The next question is how shall one proceed to study them? My answer must be very partial and unsatisfactory. Here it is that technical skill, trained eyes and muscles, and refined methods come in; these are acquired only by painstaking work, not by reading what some one has done and how, nor by seeing some one do work can the necessary touch of the learned be acquired; the student must work and be patient and hopeful. I shall, therefore, only attempt to offer a few hints to beginners, hoping they may assist some in gaining that experience which brings skill and the pleasure of successful investigation; when the need of better technique is felt it will be found out and acquired. First of all, a good microscope is necessary, supplied with at least the following objectives and a full set of eye-pieces: a good inch, a *long working-distance* quarter for searching, a first-grade quarter or fifth, and a homogeneous eighth or tenth of widest angle, and most perfect construction attainable. A dissecting-microscope of some form will be found a great aid, while a camera, compressoriums, pipettes, needles, scissors, pocket lenses, etc., can scarcely be considered less essential than the microscope. I cannot too strongly urge the student to use re-agents, and so far as possible make out the reason for the use of each, and why it gives such results as it does. The most useful of these are not many and are simple. Of these, osmic acid requires the greatest care, but it is very useful in fixing Infusoria with their bodies expanded. This may be done by isolating them in a drop of water and carefully inverting the slip over the open bottle containing the standard solution of the acid. A weak solution of iodine in potassium-iodide is useful in the same way, besides those species which move so rapidly and incessantly that it is impossible to more than glimpse their parts and structure may be quieted by this fluid without materially changing their forms; moreover, it is an excellent fluid in which to mount and permanently preserve these frail specks. A highly dilute solution of tannin in glycerine is useful in demonstrating the cilia, and also in causing the protrusion of the trichocysts. Acetic acid, caustic potassa, carmine in a fine state of division in water, and various staining solutions are each useful for

certain demonstrations. For example, suppose it is desired to examine the horny armature of the "velum" of *Trichodina pediculus* from the *Hydra*. A host may be taken and placed in a drop of water on a slide, the infusorian will leave the host as the water gets stale, or on the application of a trifle of the iodine solution already mentioned, then remove the *Hydra* and allow the drop containing the animalcules to dry; when this is done carefully dissolve away the substance of the dried bodies by the potassa solution, carefully wash and perhaps apply a little aniline solution, remove the stain and cover, and the complicated apparatus may be seen with the one-eighth inch objective very well. I repeat my advice, early acquire the habit of using and depending upon re-agents, so as not to become a mere gazer.

I have succeeded fairly well in mounting vorticellids, for example, in the iodine solution. They are first fixed by the shortest possible exposure when expanded to the fumes of osmic acid and mounted in a cell, the solution just strong enough to show faint color. I prepare the cell as follows: first, a ring of zinc white, after drying, a thin metal ring cemented on, then another ring of zinc white, after drying, a coat of rubber-cement, when thoroughly hardened the ring is finished and the mount may be completed.

I will add a word to urge the student to keep full notes and keep them by such a plan that reference to them is easy. I recommend the use of cards, the size of postal cards, kept in "postal card files;" these are alphabetically arranged, and readily found at any moment. A note-book for longer descriptions than can be made on a card may be used, and the subject only placed on the card with a reference to the page of the note-book. Sketches and photographs usually prove to be the most valuable notes.

The foregoing "introduction," though much longer than I expected it to be at the outset, gives a bare outline of the equipment for successful study of Infusoria, except that no mention has been made of the various manuals, papers and journals that one must have. It is safe to recommend that the furnishing of books and appliances be made as complete as possible. If what is known of the group is within reach, and the microscope in use is capable of revealing as much as the best, the student at once gains confidence in his work, and courage to master the intricacies of the subject in hand.

Let us turn now from the general to the specific, and consider the few rare or new forms referred to at the beginning.

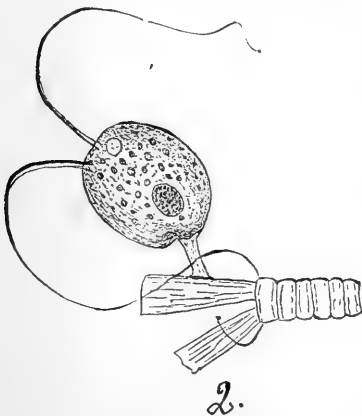
Podophrya inclinata, n. s. (fig. 1.) Body nearly spherical in young examples, somewhat pyriform in the adult and inclining to one side or overhanging the pedicel; the surface is smooth and the endoplasm granular. The nucleus is subcentral, usually below the centre in the adult, spheroidal, granular. The contractile vacuoles (few in number, rarely more than two seen) are small, pulsating very slowly, placed anteriorly. The tentacles are scattered about the anterior extremity, not numerous, slightly capitate.

The pedicel is narrow below, rapidly thickening above, usually nearly straight, sometimes decidedly curved or even sigmoid.

Length of the body $\frac{1}{750}$ of an inch; height of the animal including the pedicel, $\frac{1}{350}$ to $\frac{1}{250}$ of an inch.

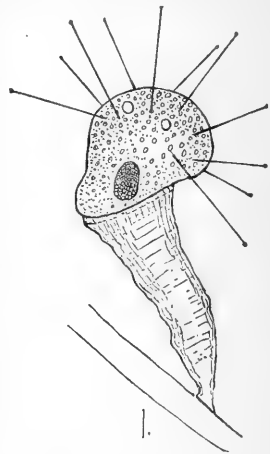
On swimming feet of *Cambarus* from the Niagara river.

Many examples of this species were obtained from crays taken in the river during March and April of the present year, while there was an abundance of ice. The characters appear to be so well marked and constant that it is readily separated from any of the described thick-pedicled species. In some examples, the pedicel is at first narrow, then at about the middle abruptly widened so that the outline is paddle-shaped; in one instance it was comparatively slender throughout and bent like the letter s.



Podophrya flexilis, n. s., (fig. 2.)

The body is sub-spherical, very flexible and plastic, endoplasm transparent, containing a few granules in the smaller examples and a greater number in the larger, so that the body is rendered opaque by them, surface smooth. The ovoid nucleus is granular,



subcentral. The contractile vacuole single, placed anteriorly, large, pulsating slowly. The tentacles are few in number (two to four), extensible, flexible, sometimes thrown out to a distance equal to six or more times the length of the body, and actively exploring the space within reach; they are apparently capitate, certainly not pointed. The pedicel is short, not exceeding one half the length of the body.

Size : $\frac{1}{1000}$ to $\frac{1}{500}$ of an inch.

On the pedicels of *Epistylis digitalis* on *Cyclops* from forest ponds filled with decaying leaves in April.

This species differs remarkably from other Podophryæ, most of which have the tentacles little or not at all flexible, and the bodies remaining nearly constant in shape and fixed in position; while in this one the body is very plastic, sways from side to side, and often in the smaller examples, the anterior extremity is bent down below the attachment of the stalk; again, the arms are incessantly exploring every nook and corner within reach, like the long searching neck of *Trachelocerca olor*, in this regard the tentacles closely resemble those of *Acineta cuspidata*. After patient search I observed the capture of food by the snake-like arms, and the manner of it indicates that the species would better be considered as belonging to *Podophryæ* than to any other genus at present established. The animal taken was a microzooid of *E. digitalis*, in size it was nearly the equal of its captor; the tentacle which held the prey was soon very much shortened, thickened and ceased its writhing, while the free one kept up its search for more. The situation was such as to prevent the use of a sufficiently high power to disclose the streaming of the endoplasm of the victim through the tube, but as the body of the captured zooid soon became shriveled, I inferred that it must have done so.

I have already referred to the two distinct sizes, one nearly twice the diameter of the other; the smaller is transparent, the larger nearly opaque, it is also less plastic, the arms relatively shorter and not seen to extend so far, but as constantly and rapidly in motion. The smaller usually have two tentacles, the others four. It seems to me that all are different stages of one species.

Carchesium granulatum, n. s., (fig. 3.) Body elongate, twice or more as long as broad, subcylindrical, slightly constricted below the peristome border, which is thickened and slightly dilated. The cuticular surface is beset with rows of distinct elevations similar to those

on the surface of *Vorticella monilata*, giving the body a coarse, granular appearance, even under a low power. The ciliary disc is moderately elevated, convex and tumid. Contractile vesicles two in number, slowly and alternately pulsating. The endoplast is long, somewhat twisted, and placed longitudinally.

The pedicel dichotomously branched without septa, few zooids in a colony. Length of body $\frac{1}{250}$ of an inch.

On *Cambarus* and plants, Scajaquada creek and Niagara river.

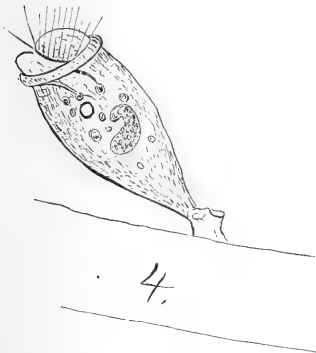
This is, I think, the only *Carchesium* thus far observed with two contractile vacuoles, a character not attributed to the Vorticellidæ in the manuals, although several species of *Vorticella* are now known to possess two. One, *V. vestita*, occurs in the same locality as this species. While it is easy to observe the two vesicles in some examples, I have not succeeded with others; my experience is similar with the *Vorticella* mentioned. This does not prove that the second one is not there, still I cannot help doubting that it is. Is then the possession of two contractile vesicles by a vorticellid a peculiarity, or, when present, due to a state or condition? I am aware that the weight of evidence at present is in favor of the constancy of the character, and when not seen there is a fault in the observation.

Opercularia humilis, n. s. (fig. 4.) Body fusiform, slightly gibbous, cuticular surface transversely striate under high magnification.

Nucleus ribbon-like, bent into a U, placed transversely. Contractile vesicle low. Peristome border thickened and slightly dilated. Lid narrow, convex, moderately elevated. Cilia ample. Membranous frill or collar slightly elevated.

When contracted, the body becomes napiform with a snout-like projection. The plastic bodies are often made to bend over sidewise until they rest upon the supporting object. The

pedicel is extremely short, a mere nodule on which the four to eight zooids are clustered.



Length of zooid, $\frac{1}{800}$ to $\frac{1}{500}$ of an inch. On *Gammarus* and *Entomostraca*.

I have often observed this species fairly clothing the antennæ of *Gammarus*, and in large numbers on smaller Crustacea. The inconspicuous collar and moderately elevated disc give the species decidedly the appearance of an *Epistylis*. It can not be easily mistaken for any other opercularian.

Lagenophrys vaginicola, Stein. This species is attached to *Canthocamptus minutus*. I have found an abundance of a form on this entomostracan which heretofore has been regarded as identical with the European animal. During the months of April and May just passed, many were examined and compared with Stein's figures and description, and ours differs constantly in the form of the lorica, viz: the lorica is not cordate, but a plain ovate, the length is equal to or greater than twice the width, and the aperture is not circular but oblong, closed as described by semicircular, prominent valves; the size of this variety is larger than the cordate one; the lorica is striate, like that of *cothurnia lata*, although not so easily made out; again, the examples are not always adnate, but attached by the posterior extremity, so that the lorica is free except the then attenuate extremity. I propose for our variety *L. vaginicola* variety *ovata*.

As the season advanced, a supposed cystic stage was frequently observed. This occurs loosely within the lorica; it is spherical in form and surrounded by short, radiating spines.

The species of *Lagenophrys*, thus far figured, are circular when seen from above, except the species and variety already mentioned; and when seen from the side are plano-convex. There occurs rarely on *Cypris*, a species which is not plano-convex in side-view, but nearly rectangular, i. e., the plano-convex type flattened, the upper surface being nearly plain, and parallel with the adnate surface. The animal nearly fills the lorica and protrudes its disc through a short tube closed by lip-like lids. I propose to call it, provisionally, *Lagenophrys discoidea*. The width of lorica is $\frac{1}{440}$ of an inch. From a swamp at Point Abino, Ontario. I hope to find it again during the present summer, and study it sufficiently to enable me to decide whether it is a distinct form or a variety of some other now known.

Is it *Gerda* or *Ophrydium*? I recently obtained from Lime lake, a few miles south of Buffalo, a number of social groups of a species resembling what I have elsewhere described* as *Gerda*

* Proc. A. S. M. vii.-44.

sigmoides. As many as eight zooids were noticed in a group, but not a trace of a surrounding gelatinous envelope was to be seen. The animals differ from those of *O. sessile*, and the groups seen were all smaller; the only real generic difference is the absence of the zoocytium. But the difference is sufficient, and the diagnosis of *Gerda* needs amending by adding *or social* to "Animals solitary," etc. If the species differs from *Sigmoides* it may be called *Gerda socialis*.

BUFFALO, N. Y.

A NEW OBJECTIVE.

BY T. J. BURRILL.

I HAVE recently received direct from Carl Zeiss, of Jena, Germany, one of his new "apochromatic" objectives, together with three oculars of special construction. The order for these was made last summer, for the University of Illinois.

Arriving, as it did, during the closing days of our scholastic year, I could only give the objective a hasty examination, and from this was obliged to admit to myself, a feeling of disappointment. I used a Bullock "professional" stand having a tube length of ten inches. This length could be increased by the draw tube, but could not be made less. The objective was ordered for the long tube and has engraved upon it: "Tubusl, 250 mm." I tried first central light both from the northern sky, which at the time was white with well distributed clouds, and from a lamp with various methods of condensation. The results were certainly good, but I could not see any improvements over the best work upon the older formulæ of Spencer and Tolles, with which I was very familiar, or upon that of Zeiss himself as represented by his well-known one-twelfth and one-eighteenth homogeneous immersion.

Trying oblique light similar conclusions were reached, except that upon looking at a dry mount of *Surirella gemma*, turned at right angles to the illuminating beam, the basket-like work between the transverse ribs stood out with conspicuous brilliancy. Of course this was not a high-class test, but the excellency of the picture was worth the record. Putting on a slide of *Amphipleura pellucida*, mounted by Möeller in monobromide of naphthalin, with lamp-light direct from mirror, the striæ were at once resolved and visible enough for recognition by any tyro. This again, however, was no advance over the performance of the older objectives named above.

With the same arrangement of light no resolution was gained upon a balsam mount of this test. No sub-stage fittings were then tried, but enough had been seen and not seen to beget the disappointment mentioned. The objective is non-adjustable; yet the evidence was not wanting of the need of correction. My tube-length being also practically fixed, there was no chance to try the effect of change in this. Putting the instrument aside for the time without enthusiasm upon its possession, I waited several days for a more favorable opportunity of better testing its merits.

Besides the mark for tube-length already quoted, there is engraved upon the objective: "Homog. Immers," "2.0 mm, Apert. 1.40." "Carl Zeiss, Jena," and "88"—the latter on the bevelled front, presumably the serial number of manufacture. The total length of the mounting, exclusive of screw, is only one and a quarter inches, the lower half nickel-plated. The oculars received are marked: "12, 22.5 mm," and "8, 34 mm." That is, one increases the magnifying power of the objective twelve times and the other eight times. They are mounted in nickel (or nickel-plate) with double diaphragms below, the outer one limiting the field to three-fourths of an inch in diameter for the "8" ocular and nine-sixteenths for the "12." They are very heavy from the amount of metal used in mounting. Over the eye-lens is screwed a curious cap with its central opening high above the glass—five-sixteenths of an inch in the "8." In my use of this ocular I was obliged to keep the eye considerably above the cap, fully an inch from the upper surface of the lens. There also came with the others a "projection ocular" (marked "6") of a very different construction and mounting. I have not tried this for its special purpose.

The screw of the objective does not fit well in the Bullock and some of Bausch and Lomb stands, though it does in a Zeiss stand ordered with the "society screw." It also does in Beck's instruments tried.

At the first leisure hours I returned to the critical examination of the apparatus and have now to detail results so far as ascertained. Having observed especially that the structural details of a test object came in best view at a focus considerably above that of the outline, indicating need of correction for thickness of cover, I replaced the tube of the Bullock stand by one made for photographic use. This has a draw-tube moved by rack and pinion. When the new objective was screwed in, the distance from the back lens to the upper

end of tube, at its shortest length, is seven inches, at the longest ten inches. Zeiss says the objectives for short tubes are corrected for 160 m. m., or about six and four-tenths inches. Trial now immediately revealed the fact that a mistake had been made, and that the objective was really intended for the short tube. I had no further difficulty in neatly resolving balsam mounted *Amphipleura* without interposing anything between the mirror and the slide. The lines showed throughout the length of the frustule and distinct enough for anyone accustomed to microscopic work to easily see them. By the aid of a micrometer I think I could have accurately counted them, though I did not try. The effect of elongating the tube was clearly perceptible with both central and oblique light. The correction is certainly for the short tube, and mine being still a little too long the best results were not attained.

I next tried a Zeiss stand, but unfortunately could not use the new eye pieces, these being mounted for the larger tubes. For this kind of work the mirror is an awkward affair. In fact I could do nothing satisfactory with this stand (Stativ I) in the matter in hand, without the Abbe condenser, and with this I could not compare the results obtained without sub-stage apparatus. But it speedily became evident that the objective did its best work at a tube length of 160 mm., thus confirming the conclusion before reached, that a mistake had been made in engraving the objective and in filling my order.

After gaining some familiarity with the objective and the oculars, an attempt was made to more carefully note just what could be accomplished and how the best results were attained. A slide of *Amphipleura pellucida* from Lake Pistakee, Wis., mounted by B. W. Thomas, of Chicago, in balsam, was chosen because the frustules are the most difficult of resolution of any in my possession. That on my Möeller's test plate is easy compared with them. I used a common coal-oil lamp with No. 2 burner, with the chimney smoked inside except a narrow space directed towards the mirror, the flame edgewise, turned rather low. The lamp set at right side thirty to thirty-four inches from mirror. The latter was carefully focused by the use of a strip of thin paper held on the slide before the objective was brought down. This focusing was attended to every time the obliquity of the mirror-bar was changed. Bullock's stand with short tube as described was used. After thus adjusting the light, if further illumination was desired a bull's-eye was placed as near the chimney as practicable and moved to proper position.

In this way, with and without the bull's-eye, the lines were distinctly shown from end to end of the diatom when the engraved mirror-bar was set at about 65° . At much less angle no resolution was obtained. At a greater angle nothing was gained, and finally the lines became less brilliant from the change in illumination.

Putting on a hemispherical lens a magnificent showing was made. The best effect was secured when the mirror-bar showed about 50° , but the lines remained visible until the angle was reduced to 27° . In this latter position, however, it was necessary to take the light from the upper portion of the mirror, so that the real angle of illumination was greater. With a small beam of light central to the mirror, 33° was the lowest angle giving perceptible resolution.

The field was equally and brilliantly white throughout, except that the limiting edge of the diaphragm was bordered by a dark red line shading to orange. When the object extended beyond the field, one could follow it, distinct and white, fairly into this red boundary line. It is, however, necessary to slightly change the fine adjustment for the sharpest focus in passing from the center to circumference of the field. The change required is very little, and when made the results near the boundary are as good as at the center.

I cannot so well describe the results with the Abbe condenser, but at its best the resolution was certainly no less satisfactory. Ordinarily, however, I prefer for central light a low-angled half-inch objective, except when simply wishing to find, mixed with other material, stained objects like *Bacillus tuberculosis*. With the half-inch as condenser, plane mirror, and the lamp as before, the results with central light were equally good, but I could not perceive that the objective gives greater promise in this respect than it does with oblique illumination. I have never before seen *Surirella gemma* so well shown. But I failed just where I have heretofore failed in resolving with central light (central beam on plane mirror and condenser carefully centered,) viz : No. 18 Möller's balsam test plate. All before this came out beautifully. I have seen balsam mounted *Amphipleura* brilliantly resolved without substage apparatus and with the mirror in central position, but by no means in this case with central illumination. Have never seen the last three tests on Möller's plate brought out with truly central light. In my hands the new objective does not do it. I have heretofore looked for the cilium of *Bacterium termo* and looked in vain, though others have seen it with presumably no better equipments. I have again failed with the new

glass. Possibly further skill in handling may secure success, but I cannot help but doubt the marked superiority of the objective over the best of former manufacture in such a test as this.

The results are admirable with eye-pieces of high power. I used a one-fourth inch solid ocular with excellent effect, though generally I do not like the magnification at the upper end of the tube. The objective works through cover glass one-hundredth of an inch in thickness.

Taken altogether, it will be seen that under the circumstances detailed, the objective has shown itself to be of very high grade among those of modern production; but, judging by results obtained, it can not reveal anything not heretofore seen under similar circumstances with the best work of at least six opticians. As an objective for practical work I am greatly pleased with it, and see no cause for hesitancy in purchase on account of the delicacy of its construction. I think, however, it quite possible that the one-eighth of same make may be still more serviceable for general use.

Now, a word as to the eye-pieces, and this story, already much too long, must close. Neither with the new objective nor with others do I find any superiority over the common Huyghenian oculars in the matter of fine and difficult resolution or definition, in the central areas of the field. The color corrections, especially as shown towards the margins are better, and there appears to be less curvature of the image, requiring less focusing for the central and peripheral parts of field. The greatest gain, it seems to me, is in the ease for the eye with the highest eye-pieces. From my experience with the "12" I am disposed to order an "18," though in practice I rarely use a Huyghenian higher than an inch or about ten in magnifying power.

CHAMPAIGN, ILL.

A PROTOPLASMIC RETICULUM.

C. H. STOWELL.

A FEW American histologists accept, in full, the teachings of Heitzman, and others, concerning the presence of a living protoplasmic reticulum in all the cells and tissues of the body.

I would advise all such workers who are after the truth in the matter, to procure a copy of the Dental Cosmos for June, and in it read the excellent article by Dr. Allan, of New York.

In the April number of the same journal can be found a paper by Dr. Abbott, who is a most devoted pupil of Heitzman, on the structure of the enamel. Heitzman beautifully pictures this delicate net-work as ever present between the so-called enamel rods. In fact he, with Abbott, claims that even in the hardest substance in the body, the enamel, there is to be seen this ever-present reticulum.

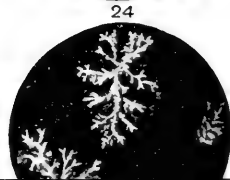
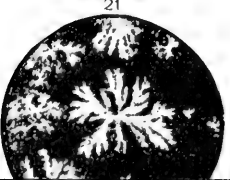
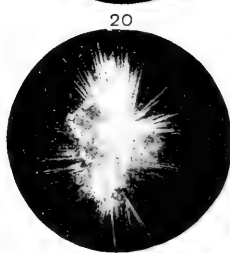
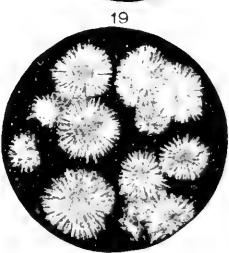
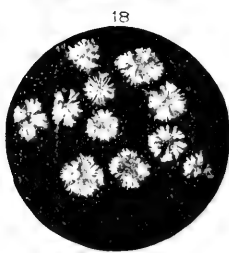
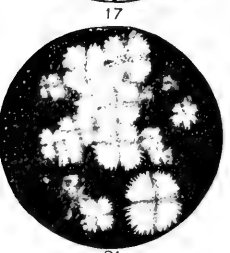
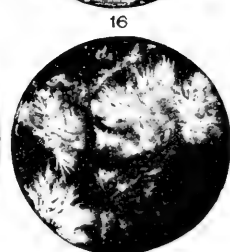
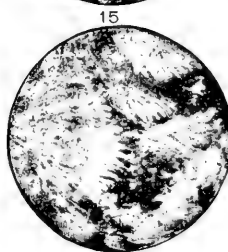
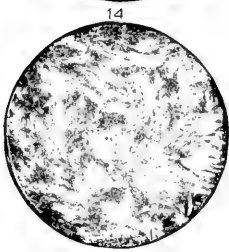
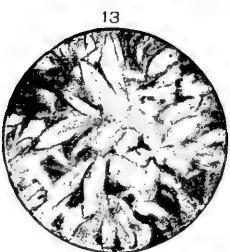
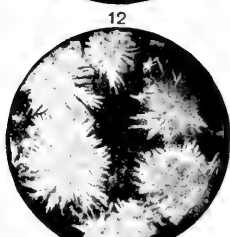
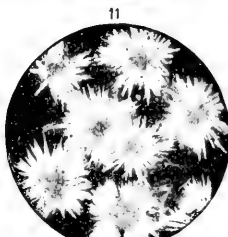
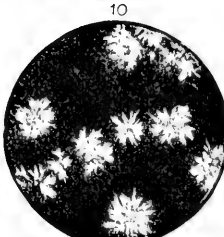
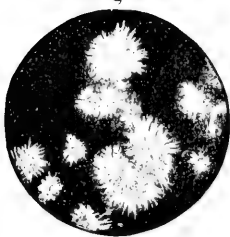
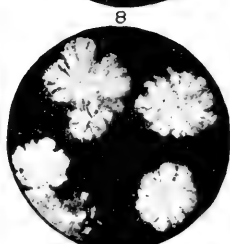
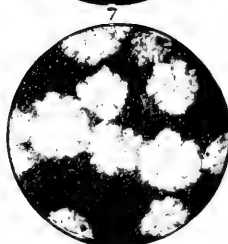
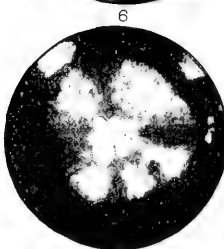
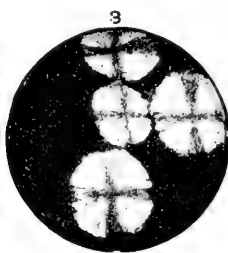
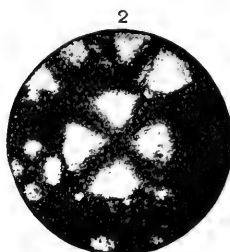
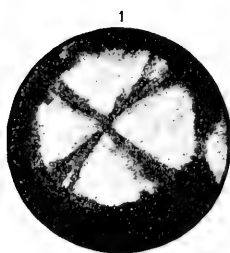
Now it seems that Dr. Allan conceived the idea that an examination of the very specimens used by these investigators to make new theories from, might be convincing to him; for the most patient work on his part had never shown him this beautiful net-work.

"An examination of the specimens" used by Heitzman and others, and from which these beautiful drawings are made, is what many of us have long desired to do. Dr. Allan obtained some of these slides and some were also sent to Dr. Andrews, of Cambridge, Mass., "whose position as an acknowledged authority in such matters is unquestioned."

Dr. Allan examined these slides with a Powell and Leland immersion, $\frac{1}{6}$; a Hartnack im., $\frac{1}{12}$; a Gundlach im., $\frac{1}{16}$, "all superior glasses, and every care was taken in all their adjustments and in managing the illumination." Each observer worked entirely independent of the other. What was the result? Dr. Allan says: "*The writer could not make out any reticulum, nor in fact anything resembling one. The specimens were worthless for the purpose intended.*" He, therefore, denied the existence of the protoplasmic reticulum as described by Abbott, Bödecker and Heitzman, said denial being based upon an examination of their own preparations.

But Dr. Andrews writes: "I have examined many slides of thin enamel, some of which were examined by Heitzman in his laboratory, and pronounced by him to show the reticulum. These specimens I have examined critically, with a most excellent $\frac{1}{15}$ of Tolles, and am assured that *nothing like a reticulum figured by him can be demonstrated in them.* In regard to the study of Prof. Abbott's slides, loaned for that purpose, I could find *no appearance whatever* of fibrils resembling the exquisite drawings made by Heitzman, illustrating the article in the April Cosmos." And yet from these very slides are made the "exquisite drawings" of the author of this new departure!

CRYSTALLINE FORMATIONS OF BUTTER AND FATS.



CRYSTALLINE FORMATIONS OF BUTTER AND OTHER
FATS.

BY DR. THOMAS TAYLOR, U. S. AGRICULTURAL DEPARTMENT,
WASHINGTON, D. C.

FIGURES 1, 2, 3 and 4. Represent primary crystals of boiled butter, from milch cows of different breeds under differing conditions of feed. x80 to 110.

Figures 5 and 6. Represent secondary or rosette crystals forming within the primary or globose crystals.

Figures 7 and 8. Represent these secondary or rosette crystals having separated from the primary crystals. The secondaries generally break up into stellate forms in the process of decay. x80 to 110.

Figures 9, 10 and 11. Represent tertiary crystals, or the third transition stage of the butter crystal; generally seen in boiled butter that has been kept several months. x80 to 140.

Figure 12. Represents tertiary crystals resolving into the amorphous condition. x140.

Figures 13, 14, 15 and 16. Represent oleomargarine which has no typical form or crystal. x80 to 110.

Figure 17. Represents oleo as it generally appears when boiled and cooled. x140.

Figure 18. Represents neutral lard when boiled and cooled. x140.

Figures 19 and 20. Represent common lard when boiled and cooled. x140 to 400.

Figures 21, 22, 23 and 24. Represent crystals of beef-fat from various tissues of the ox. Omentum, kidney, marrow of femur and round. x65.

The crystals are obtained by simply boiling, straining and cooling the fat, at a temperature of about 60° F., using no chemicals.

SLIDE-INDEX.

EUGENE PINCKNEY.

THE catalogues prepared by Ward and others may serve their purpose as a record, but not as an index. Every worker needs a reliable slide-index, to which he may turn for instant reference. I suggest the following: Purchase a six-quire blank book, commonly known as "Record" form, plain blue lines for

writing and one vertical red line about one inch from left-hand side of page. With a ruling-pen, draw a second similar red line about half an inch to right of first one. This gives three spaces on each page. Now index the edges, or right-hand margin of the pages, giving each letter its due proportion. In the first space write the general name as "Amphipleura," while in the third space you write the specific name as "pellucida," together with the number of the slide. The second space is for a key, or catch-word, and for this purpose a set of abbreviations is used. In my book Di.—Al. F.—V.—His.—M.—Tri.—signify Diatoms—Fresh-Water Algae—Marine Algae—General Vegetable—Animal Histology—Mineral—and Trichomes. Selecting any letter of the index, a glance will instantly detect any diatom on the page, or indeed any other class of object sought. I have tried the "vowel" plan and others, but the above is superior.

It is convenient to keep also a plain numerical catalogue, on Ward's plan or simpler, as work or necessity requires.

The cut of my label shows space for names and number.

DIXON, ILL.

PROCEEDINGS OF SOCIETIES.

THE SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE regular fortnightly meeting of this Society was held at its rooms May 25, 1887, President Wickson in the chair.

Numerous additions were made to the library and files. Chas. C. Riedy presented several books to the Society, among them being Kölliker's "Microscopical Anatomy" and Peck's "Treatise on the Achromatic Microscope."

The Secretary reported that the diatomaceous earth recently received from St. Helena had proved to be very rich, but was refractory and difficult to clean. Various suggestions were made as to the best methods of treating such deposits.

J. Z. Davis exhibited a slide showing the net-work of spicules in the beautiful "glass-rope sponge," *Euplectella speciosa*.

The remainder of the evening was devoted to perfecting arrangements for the Society's Annual Reception, to be held at Pioneer Hall on the 28th inst.

May 28, the annual reception tendered by the members of this Society to their friends was held in Pioneer Hall. The audience comprised many of the most prominent names in the social, scientific and educational circles of this city, and the entertainment was evidently thoroughly enjoyed by all present. Never before has such a display of microscopes been seen on the Pacific Coast. Arranged along seven long rows of tables were no less than sixty-four instruments. Those who find pleasure in examining beautiful brass-work would have found ample and agreeable employment in the examination of the microscopes alone, for these embraced examples of the exquisite skill of all the leading opticians of the world. The list of objects shown was a most attractive one, and, as the best of lenses were used in their display, and careful attention was given to obtaining the best effects of illumination, the results were eminently satisfactory. It may incidentally be remarked as a fact most gratifying to all interested in the progress of microscopical investigation on this coast, that although the local microscopical society is one of the oldest in the country—being now in its fifteenth year—it has lost none of its vitality, but has, on the contrary, at present a larger membership, a larger and finer library and cabinet, a larger average attendance at meetings, and in every way better prospects for useful work in the future, than at any previous time in its history.

The following is a list of some of the objects exhibited :

The first exhibit was that of Dr. C. P. Bates, who showed the ever-beautiful circulation of the blood in the gills of that interesting batrachian, *menobranchus*. By means of an ingeniously constructed "life-slide" the animal was supplied with a current of fresh water and was thus kept in full vigor during the entire evening.

Few of those who have seen the common California wild-flower, *orthocarpus purpurescens*, would have expected to find such beauty in its seeds as was revealed by the fine binocular of A. S. Brackett. Each seed is inclosed by a delicate transparent latticed receptacle, thus presenting a charming appearance when well illuminated.

The exhibit of A. H. Breckenfeld comprised double-stained sections of the human scalp, both vertical and horizontal, thus giving an excellent idea of its structure ; a very fine double-stained section of a pine-needle, and, finally, a plump specimen of that universal pet, the domestic flea, blazing with the crimson radiance imparted by polarized light.

J. G. Clark presided over an attractive exhibit consisting of gold-plated diatoms (*Arachnoidiscus Ehrenbergii*), a double-stained section of Dodder, parasitic upon Heath, and the beautiful peristomes or spore-receptacles of the well-known moss, *Funaria hygrometrica*. Neat explanatory cards were placed with each object.

J. E. Davis exhibited a beautiful specimen of the "glass-rope sponge" (*Enplectella*) under a bell-glass, and also its net-work of silicious spicules under the microscope. He also showed a fine slide of the interesting diatoms and polycistina dredged from the ocean's bed at a depth of 1,750 fathoms. Some rough diamonds (Californian and South African) also attracted much attention.

Dr. S. W. Dennis exhibited slides of the optic nerve under amplifications of 30 and 750 diameters respectively, from which a good general understanding of its structure could be obtained. He also showed a very fine injected section of cat's jaw with teeth *in situ*, and finally as "Oh my" slides, a fine example of that gastronomic dainty, the cheese mite, and a lively collection of vinegar eels.

A fine section through the entire human eye was shown under a low power by Dr. Henry Ferrer, who also exhibited excellent preparations of the human retina, and of the embryonic eye of calf. The elegant Zeiss stand and apochromatic objectives belonging to this gentleman received much admiring attention from the experts present.

Prof. Hank's exhibit of an American coin was an interesting case of making much out of little. It also evidenced the curious fact of "inversion of relief," or the seeing of depressions by some observers, where others see elevations.

Two beautiful slides of arranged diatoms were shown by Dr. J. H. Hatch. One of them was of peculiar interest from its containing the monogram of the society, in diatoms, and having been presented to it by one of its corresponding members, Captain Mortimer.

The exhibit of A. M. Hickox comprised a fine mount of the head of the jumping-spider (*salticus scenecus*), showing the beautiful gleaming eyes, and a scale of an eel under polarized light and selenite plate, bringing out all the well-known gorgeous prismatic hues.

Diatoms shown under different styles of illumination, formed the exhibit of Henry C. Hyde. The slide which attracted most admiring comment was one of arranged diatoms (mounted by Rinnbock), shown on a beautiful dark ground obtained by Zentmayer's Abbe condenser.

Dr. Thomas Morffew's exhibit illustrated very finely the structure of human teeth. Longitudinal sections of an incisor, a cuspid and a molar were shown and their characteristics duly explained.

Dr. S. M. Mouser, with a very fine array of instruments, exhibited an interesting slide of *Trichina spiralis*, and also a series of pathogenic micro-organisms grown in his biological laboratory, and shown under high-power objectives, giving exquisite definition.

The lingual ribbon or tongue of *Haliotis*, exhibited by W. F. Myers, strikingly illustrated the characteristics of this peculiar organ of the Molluscæ. The beautiful iridescent shell of this animal was also shown, both microscopically and in its entirety.

The resplendant scales of the diamond beetle were shown by Charles C. Riedy under a microscope interesting from its having been in use for half a century. He also exhibited the well-known test diatom *Pleurosigma angulatum* under an amplification of 2,000 diameters. The most attractive objects in his exhibits, however, were the beautiful shells of Foraminifera shown by the cool, dark-ground illumination obtained by the Bausch & Lomb-Abbe condenser.

Sand from Alameda beach formed an attractive object as shown by Dr. Riehl, who also exhibited living diatoms in active motion, collected in San Francisco Bay.

Dr. J. M. Selfridge presented an attractive exhibit, comprising a very fine mount showing the villi in duodenum of rabbit, another of the beautiful crystals of cinnibar, and last, but by no means least, the circulation of the blood in the mesentery of the frog.

Dr. J. H. Stallard's exhibit was the largest in the hall, he having no less than thirteen microscopes under his charge. The entire series was devoted to illustrating the structure of both normal and diseased human lungs. The slides shown were all masterly preparations, and the opinion was universally expressed that the entire exhibit formed the finest presentation of the subject ever seen here.

The subject chosen by the President of the Society, E. J. Wickson, was that of "Insect Fruit Pests." Living individuals of the Cottony Cushion Scale and the San José Scale were shown, and also specimens of the egg deposit of the *Lecanium* Scale, and of the larval form of *Chiclorus bivulneris*. Colored engravings, showing the appearance and ravages of some of these little destroyers were also exhibited. Mr. Wickson's table was the last on the programme, and its inspection brought to a close an entertainment which must be pronounced an unqualified success.

A. H. BRECHENFELD, *Secretary*.

THE Stowell Microscopical Club, of Albion College, held its eighth soiree at the College Museum, June 18th. Some forty objects were exhibited and discussed, much to the satisfaction of those present. The club is in a flourishing condition, with the following officers for the current year: Elliott R. Downing, President; Cora E. Mather, Vice-President; Fred. B. Mumford, Rec. Secretary; Alin B. Hall, Cor. Secretary; Delos Fall, Treasurer.

ELEMENTARY DEPARTMENT.

SIXTH LESSON.

“CLEANLINESS IS AKIN TO GODLINESS.”

WITHIN the scope of these lessons is now embraced all that is necessary for the carrying out of ordinary histological work. This scope will be much enlarged by the addition of a few stains, and to the consideration of these the present lesson will be devoted. The reader is advised, however, to continue his section-cutting from the various organs, and to prepare them in the manner already described, in order that he may gain facility in the work. The material which has been preserved will be found well hardened, and most suitable for the purpose. If injected specimens are desired they can be prepared after the method described by Mr. Reynolds in the May number of this journal. The procedure will be referred to in these lessons at the proper time. Injected specimens are only valuable for the study of the circulation—for any other purpose they are almost if not quite worthless. Their æsthetic value depends on the individual taste.

STAINS.

The advantage to be derived from the use of stains should be at once apparent. The decided color serves not only to draw out the specimen from the obscurity of the surrounding mounting-medium, but aids very materially in the differentiating of its component parts. This is more especially true of the selective stains, *i. e.*, those which do not stain all parts alike, but select a certain tissue to which they lend their color, thus revealing its distribution and making it far easier to study. This selective staining is also used as a means of diagnosis, particularly in bacteriology. This selective action can be utilized for the application of several different colors to the same

specimen. A stain which, for instance, prefers the connective tissues, can be used and then followed by one partial to epithelium. The contrast in a specimen containing these elements and thus stained will be very marked. These stains can often be combined in one fluid, when, with two, it is called a double-stain; with three, a treble-stain, etc.

Though the number of stains is very large, only a few will be given here—sufficient, however, for nearly all histological work. If properly used they will be found to give excellent and sharp definition. They may be classified in this manner:

General Stains:

Ammonia-carminé,
Glycerine-carminé,
Picric acid.

Selective Stains:

Hæmatoxylin,
Silver nitrate,
Osmic acid.

Double Stains:

Picro-carminé.

The formula for ammonia-carminé will be found in the last lesson. This is an old and tolerably good stain, but it does not give a pure carminé tint. This is due, probably, to the small amount of ammonia remaining. Again, the solution tends to turbidity and decomposition, especially when the ammonia is finally lost. To prevent this precipitation and decomposition, and to retain the true carminé color, Joseph W. England, Ph. G., gives a formula in the *American Journal of Pharmacy* for July, 1887, which, though designed for a different purpose, the writer has tried as a stain with most satisfactory results. It works evenly and quickly, and imparts a most delightful color. The following is the formula:

GLYCERINE-CARMINE.

Carminé, (No. 40)	4 drachms.
Water of Ammonia,	3 fluid-ounces.
Glycerine,	3 fluid-ounces.
Water, q. s.	to 8 fluid-ounces.

“Rub the carminé into a fine powder, in a wedgwood mortar, make a paste with and dissolve in the water of ammonia and then add, with constant trituration, the glycerine. Transfer to a porcelain capsule and heat upon a water-bath, until the liquid is entirely des-

titute of ammoniacal odor, cool and add the water. The entire removal of the ammonia gas requires the constant stirring of the liquid with a glass rod, and rather lengthy heating.

The finished product is a permanent, deep ruby-red liquid, perfectly transparent, destitute of ammoniacal odor and mixes, without turbidity, with all aqueous solutions. About ten drops of this solution, added to a drachm of distilled-water, will stain a specimen nicely in about five minutes."

PICRIC ACID.—A saturated, aqueous solution can be made by adding twenty grains of the acid to three ounces of distilled-water, and left, with occasional shaking, for twenty-four hours. It should then be filtered to remove the excess of crystals. This solution stains very rapidly, and gives a firm, yellow color. Though a rather diffuse stain, it has a preference for epithelial structures. It can be used for hardening small pieces of soft tissue, staining them at the same time. Specimens thus prepared take picro-carmin most beautifully.

The following is Friedländer's formula, a most excellent one:

Hæmatoxylin,	2.00.
Alcohol,	100.00.
Distilled - water,	100.00.
Glycerine,	100.00.
Alum,	2.10.

Dissolve the hæmatoxylin in the alcohol and slowly add the glycerine. Dissolve the alum in distilled-water and add cautiously to the first mixture. This makes a permanent fluid, but it is better to filter before using, as some precipitation may have occurred. It does not attain its best powers under a week or ten days after making. This solution makes a most elegant nuclear stain. If it be desired to differentiate the connective tissues as well, it may be followed by a dip in the picric-acid solution. This makes a very pretty double-stain. Hæmatoxylin-stained sections must be preserved in Canada balsam, as the color is eventually destroyed by glycerine.

NOTE.—The writer has had several unsatisfactory preparations of hæmatoxylin made. The cause was supposed to be that the extract was used instead of the hæmatoxylin. Since using the latter no trouble has been experienced.

SILVER NITRATE.—The formula and method of using this solution will be found in the fourth lesson, page 172.

OSMIC ACID.—This can be kept as a one per cent. aqueous solution, and should be carefully protected from the light. For staining it should be diluted with distilled-water to one-tenth to one-fifth per cent. solution. It acts slowly, requiring from six to twenty-four hours. It selects fatty tissue, staining it a delicate black or brown. Sections stained with this acid should be preserved in glycerine. The one per cent. solution can be used as a hardening medium for nerves and small pieces of tissue. Its penetrative power, however, is not great, therefore, the pieces to be hardened should be small.

PICRO-CARMINE.—The formula which has proved most satisfactory is that prepared after Friedländer, as follows:

1. Carmine,	1.00.
Water of Ammonia,	1.00.
Distilled - water,	50.00.

Rub up the carmine with the ammonia and slowly add the water.

2. A saturated solution of Picric acid.

Solution No. 2 is added to No. 1, drop by drop, till the precipitate, which forms at first, is no longer dissolved by stirring. The amount of picric acid necessary is proportionate to the quantity of ammonia present. The mixture is now filtered, and for every 3 ounces a few drops of carbolic acid are added, to prevent decomposition of the fluid. Any cloudiness which may subsequently ensue is dispelled by a few drops of liquor ammoniæ.

This is an exceedingly valuable stain as it acts quickly—a few minutes only being required—and defines sharply. By it the nuclei are tinged a deep-red, the connective tissues assuming a brighter color, whilst muscular tissue, epithelium, etc., have the bright yellow of picric acid. If the section is first placed for a few minutes in a dilute aqueous solution of picric acid, the result will be more brilliant.

The stains given above, with the exceptions of the picric and osmic acids, are for staining single sections. Specimens can be stained in bulk before cutting, though the procedure cannot be recommended, as the results are generally uneven and unsatisfactory. As, however, the hardening is accomplished at the same time, it may be used as a rapid method. Alcoholic solutions of picric acid, hæmatoxylin or eosin, prepared rather weak, are fluids which act in the way described.

HINTS.—Before placing in the staining-fluid, all sections should be carefully washed in water to remove all traces of alcohol, as this chemical may precipitate the stain.

Do not stain more than two or three sections at a time, and be sure that they are carefully arranged in the staining-fluid. All folds and wrinkles should be removed, to allow even action on all surfaces. With hæmatoxylin particularly, a wrinkled section will be ruined.

Nuclei can be made prominent by over-staining, and then removing the superfluous color with reagents. Leave a section in carmine till it possesses a dark carmine color. Now wash thoroughly in this fluid:

Hydrochloric Acid,	5.
Alcohol,	55.
Distilled Water,	35.

It will bleach the specimen, the color coming out from all portions excepting from the nuclei, which will then show up most brilliantly. The same liquid may be used with hæmatoxylin.

As a rule, a section stained slowly in a weak fluid will do better than one stained quickly in a strong one. This is especially true of the carmines.

The reader is advised to practice carefully with these stains, timing each section, and inspecting the result, and thus learning the exact exposure required. With a little practice, though the beginning be discouraging, success will soon be attained.

EDITORIAL.

THE TENTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF MICROSCOPISTS.

AUGUST 14th, 1878, there met in Indianapolis a National Microscopical Congress, instituted at the instance of the Indianapolis Lyceum of Natural History, with the purpose of forming a National Association. Among those present were a large number of the prominent microscopists of this country. A committee on permanent organization was appointed by the President of the Convention, Dr. R. H. Ward, of Troy, N. Y., and from the endorsed action of this committee sprang the American Society of Microscopists. With its subsequent growth most of our readers are familiar, and to-day know it as a body of far-reaching influence and steady progress.

We have received from Dr. D. S. Kollicott, Secretary of the Society, a circular giving the arrangements for the tenth annual

meeting, which will be held in Pittsburgh, Pa., beginning August 30th and lasting four days. From this circular we take the following data:

"The time is set for the week preceding the meeting of the International Medical Congress at Washington, and will therefore be convenient in both time and place for those who desire to attend both conventions. It is hoped that we shall have the pleasure of welcoming at this meeting distinguished men of Science from abroad as well as from our own country, who may be on their way to the Medical Congress. The value and position of our organization have been established, and it is confidently expected that many more of the working microscopists of the country will join the Society at the coming meeting, and so help to make it the center of active microscopical research.

"It has often been a matter for expressed regret that * * * so little opportunity had occurred for becoming acquainted with one another. This has led to the attempt to make the Pittsburgh meeting an *en masse* affair, so that it may be a social as well as a scientific success. The Monongahela House is well suited for this purpose. There are sufficient rooms for all, and convenient reception rooms, which will be at the disposal of members. It is urged upon all to make their home at this house. The rates will be \$2.50 a day.

"It is unnecessary to urge the claims of the 'Working Session.' * * * The preparations for this session are entrusted to a special committee consisting of Hon. J. D. Cox, Prof. T. J. Burrill, and the Secretary.

"During one evening of the week there will be a popular exhibition of objects and microscopes, and all members attending are urged to bring their microscopes and good objects for this occasion.

"Members are once more warmly urged to have manuscript ready when read for the printer. The publication of the proceedings ought not to be delayed.

"Inquiries concerning local arrangements may be addressed to Jas. H. Logan, 804 Penn Building, Pittsburgh, Pa. Titles and abstracts of papers should be sent as soon as practicable to the Secretary, D. S. Kellicott, 119 Fourteenth St., Buffalo, N. Y."

We earnestly urge all who are interested in microscopy to be present and become members, if they are not already such. The Society is doing a good work and wishes to extend its usefulness. Be there, then, if possible, and make the decennial meeting one long to be remembered.

The September number of THE MICROSCOPE will contain a full report of the American Society of Microscopists meeting at Pittsburgh. As this meeting occurs on the 30th of the current month, our next issue will be delayed a few days; but it will be worth waiting for.

We learn that Miss M. A. Booth, Longmeadow, Mass., is giving instructions in slide-mounting. They who have seen samples of her work should be glad of an opportunity to learn how it is done. We wish her success in this new field.

Owing to a mistake, for which we are responsible, the second paper by Mr. Quimby, on "Insect Preparation," was not received in time for this issue. It will appear in September.

Mr. Arthur Doherty's address is, General Postoffice, Sydney, New South Wales, instead of Manchester, Eng., as given in our last issue.

ACKNOWLEDGMENTS.—From James B. Shearer, Bay City, Mich., a number of most admirable photo-micrographs. From Miss M. A. Booth, Longmeadow, Mass., five bottles of washed diatoms from various sources; also, slides of same, exceedingly well mounted.

TECHNOLOGY.

QUICK METHOD OF MOUNTING DRY OBJECTS.

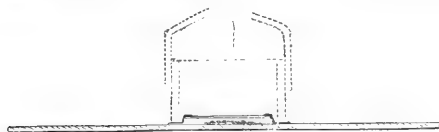
THE *Scientific American*, among other excellent microscopical notes publishes the following: There is a certain class of microscopic objects that need little or no preparation for mounting, and require no protection beyond a well-secured glass cover. Many of the objects are interesting, and, in some degree, valuable; but the microscopist considers them hardly worth the trouble of mounting. For such objects the method shown in the annexed engravings is of great utility, as it permits of enclosing the object quickly, completely, permanently, and in presentable form; and while it seems especially adapted to such objects as are common, and are liable to remain unmounted, it is, of course, applicable to almost any dry object.

To carry out this method only two articles in addition to those usually possessed by microscopists are required, one being the ring with an internal flange at the top and an external flange at the bot-



tom; the other, a heating tool consisting of a ring of brass attached to a suitable handle.

The rings, of which the walls of the cells are formed, are spun or stamped from disks of Britannia metal, sheet brass, or other sheet metal, with a narrow internal flange or fillet at the top for receiving



the cover-glass, and a wider external flange at the bottom for attachment to the slide.

The rings vary in depth according to the depth of cell required; the under surface of each ring is coated with thick shellac-varnish and allowed to dry thoroughly. When the varnish is dry and hard, a clean cover-glass is dropped into each ring, and the ring is placed bottom upward on the mounting-stand and heated until the shellac melts and thoroughly covers the edge of the cover-glass: the ring is

now allowed to cool, when the cover will be ready for use. It will, of course, be understood that a quantity of rings and covers are thus prepared and held in reserve; in fact it is to be hoped that the manufacturers of microscopists' supplies will furnish the rings and covers thus prepared ready for instant use.

The object to be protected is attached to the slide by means of cement in the usual way. A ring containing a glass cover is arranged over the object and the heating tool is warmed and placed upon the outer flange of the ring as shown in the sectional view, Fig. 2. By this means sufficient heat is imparted to the ring to melt the shellac upon that portion touched by the heating tool, and cause it to attach itself to the glass slide. It is the work of an instant to cover an object in this way, and the slide needs no further finish; but the operator may, if he chooses, lacquer the rings to prevent them from tarnishing. A thin ring provided with the coating of shellac may be applied to an ordinary balsam mount to increase its security.

By applying a suitable cement to the ring, a liquid-cell may be made. The object to be mounted in the liquid-cell is wet with the liquid and placed on the slide, the ring is then secured in the manner above described, and the liquid is afterward introduced into the cell through an aperture previously made in the side of the ring; this aperture is stopped with cement, applied with a hot wire or needle.

It is often desirable to diminish the magnifying power of an objective, and at the same time increase its penetration. For example, if one possesses a one and a half or two-inch objective and desires to examine objects like minerals in the natural state, crystals, seeds, etc., he will find it necessary to focus up and down upon the object to see it in all its parts, a three or four-inch objective would furnish the desired power but it is not at hand. To increase the focal length and at the same time enlarge the field and deepen the focus it is only necessary to place a double-convex lens of say five-inch focus about half way down the draw-tube; the action of such a lens is the reverse of that of an amplifier.

ABSTRACTS.

COLOSSAL NERVE-FIBRES OF THE EARTH-WORM.

Prof. F. Leydig, after referring to the views of other anatomists, gives an account of his own re-examination of the colossal nerve-fibres of the ventral ganglionic chain of

the earth-worm, (*Zool. Anzeig.*, 1886-7). They may present a quite homogeneous interior, even after treatment with reagents, and again, with certain hardening fluids, such as chromic and acetic acid, they may exhibit certain differentiations. A band of granular axial substance is seen in transverse sections, in which the granules have an angular form, and it is possible to convince one's self that there is an extremely fine plexus, in which the dots are the nodal points. There is, therefore, a spongioplasm, in the meshes of which a hyaloplasm is contained. It seems that in transverse sections, the median or larger of the colossal fibres is divided by septa, arising from the cortical layer, into two halves, each of which has its own axial bands. This is clearly the commencement of what, in other genera, is the absolute division of the fibre into two tubes (*e. g.* *Stylaria*). Careful observation reveals the presence of intermediate stages between the ordinary and colossal fibres; this is best seen in the region of the ganglia. The author directs attention to the relations between the colossal fibres and what he has already taught as to the structure of the nerves of invertebrate animals. To understand thoroughly the nature of the colossal fibres it is necessary to extend investigations to the anthropoda, where likewise there are colossal fibres, which are true elements of the nervous system.—*Journal Royal Microscopical Society*.

MORPHOLOGY OF THE SPOROPHORE IN MOSSES.—In a recent meeting (Jan. 20th,) of the Linnean Society, Mr. J. R. Vaizey read a paper on the morphology of sporophore in mosses. The "central strand," surrounded by a single layer of cells is composed, as is well known, of an outer cylinder of elongated cells with somewhat thickened walls and a central region of smaller thin-walled cells. The former Mr. Vaizey calls *prophloem*, the latter, being conductive of water, *proxylem*. This proxylem only differs from the xylem of vascular plants "in the absence of spiral thickening and lignification of the cells." "The prophloem differs still less from phloem, though no sieve-tissue has been discovered; but this is lacking in some vascular plants." The conclusion drawn is that mosses and vascular plants have descended from a common ancestor, similar to the anthocerathae.—*The Botanical Gazette*.

NEWS AND NOTES.

BEGINNING with the present volume, *Science* has changed its form with an idea to economy; and though it still contains the same amount of valuable matter as heretofore, the annual subscription price has been reduced to \$3.50. It deserves a still wider circulation.

DR. GEORGE H. M'CASSEY contributes to the May *Archives of Dentistry* an interesting paper on "Microscopy and Histology for Office Students," which contains much sound advice, and will undoubtedly be read with profit by many who are not "office students."

READERS who are acquainted with the writing of Mr. Ellerslie Wallace, Jun., will be glad to hear that he will edit the new edition of the *Amateur Photographer*, to which he will contribute two chapters on paper negatives, and photo-micrography. The book will be issued by Porter & Coates.

BOOK REVIEWS.

PRACTICAL URINE TESTING. A Guide to Office and Bedside Urine Analysis for Physician and Students, by Charles Godwin Jennings, M. D. Detroit, D. O. Haynes & Co.

At a time when so many works on urine analysis are appearing we naturally turn to the preface for the author's reason for adding another book to the list. We find no excuse, however, and it is evident that the author expects it to make a place for itself among its numerous rivals. In glancing over the book one is struck with its eminently practical character. All unnecessary verbiage is eliminated to an extent often of making the statements rather dogmatic.

The arrangement is logical. Part I. treats concisely of the physiology and pathology of the urine, and discusses the limits and utility of the various chemical tests. Part II. contains a systematic scheme for urine analysis unencumbered by physiological or pathological data. Chapter 1 of this part deals with qualitative analysis, and the student has before him a complete system which he can follow through with the greatest convenience. This is followed by a chapter on quantitative analysis, in which particular attention is given to the ready, approximate methods so valuable to the physician; a chapter on microscopical examination and one on apparatus and

reagents. This arrangement is a new one for works on this subject, and is, we think, excellent. Turning to the important subject of albuminuria, as an example, we find a fairly satisfactory article. Functional albuminuria receives marked attention, and all the new tests for albumin are considered and their value discussed.

In addition to the ordinary methods, directions are given for testing urine with tablets and test-papers. This will be a welcome addition to those who wish to make use of these convenient methods. The book is fully illustrated and fairly well bound and printed. The book is concise, practical and thoroughly up to the times and we heartily commend it to the student and busy practitioner. The publishers have generously undertaken to furnish all the reagents and apparatus which the work calls for, a great convenience to those living away from centers of chemical supplies.

INTRODUCTION TO THE STUDY OF LICHENS, with a supplement and ten plates.
By Henry Willey, New Bedford, Mass. pp. 272. Published by the author, price \$1.00.

In publishing this Introduction Mr. Willey has rendered a service alike to beginners and advanced lichenists. The object of the work, as the author says, "is to prepare the way in some measure for the study of the great writers on the subject," and in this he has succeeded most admirably. The plates, ten in number, in black and white are placed at the end of the book, and serve their purpose in illustrating the text. We trust that this excellent introduction may lead to renewed interest in this greatly-neglected branch of botany.

A PRIMER OF BOTANY, by Mrs. A. A. Knight, pp. 115. Boston: Ginn & Co., 1887.

LITTLE FLOWER PEOPLE, by Gertrude Elizabeth Hale, pp. 85. Boston: Ginn & Co., 1887.

These two little books are sure to find a welcome in the school room and in the home, and not only will they recommend themselves to the teacher, but, if properly used, will be readily accepted by the youngest pupils. Mrs. Knight teaches her lesson by a series of short and comprehensive questions, leading the pupils to examine and think for themselves, and supplying whatever information and practical demonstration may be necessary to fix the ideas in the youthful mind. Miss Hale, on the other hand, appeals to the imagination, and in clothing the flowers in the garb of fairy-folk, teaches an equally acceptable lesson, which will prove attractive either to old or young. Both books are well illustrated. We commend them to all who have young children in their charge.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be given ONE INSERTION FREE OF CHARGE. Dealers are referred to our advertising department.

LABELS for Slides; also, Slides and Material.

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FOR EXCHANGE.—Diatomaceous Earth from Los Angeles, for good mounts.

M. H. ALTER, M. D., 41 South Spring St., Los Angeles, Cal.

FOR SALE.—A Bausch & Lomb Universal Stand, a $\frac{1}{2}$ and 1-5 objectives, glass stage and slide-carrier, slide-cabinet, about 50 mounted slides, slides, cover-glasses, stains, etc. A complete outfit, new, being used about three months. Good reasons for selling.

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SALICINE-SLIDES FOR POLARISCOPE.—For exchange for thoroughly good histological or pathological mounts, or for sale, a few magnificent Slides of Salicine Crystals, prepared by a new process. The most gorgeous ever made. Also, some remarkable slides of urinary deposits, including tube-casts (hyaline, waxy and granular), epithelia of kidney, bladder, urethra, vagina, etc., blood, pus, etc., stained with eosin and osmic acid.

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C. L. PETICOLAS, 635 Eighth St. N., Richmond, Va.

FOR SALE—One copy Van Heurck's Synopsis Diatoms, Plates bound, best library, text unbound, in perfect order. Price \$40. Also 1-10 objective, Homo. im., 125° balsam angle, made by Herbert R. Spencer in 1883. Cost \$80, will sell for \$55. Perfect order, used very little. Address

H. F. DOUGLAS, Fenton, Mich.

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J. G. DENGLER, Sellersville, Pa.

FOR SALE—A perfectly new Bausch & Lomb Universal Microscope; has never been used. This includes two eye-pieces, one with micrometer; a 34 inch and a 1-5 inch objective; a camera lucida, a test-slide, pliers, slides and covers. Purchaser receiving in addition a copy of Carpenter's "Microscope and its Revelations," Stokes' "Microscopy for Beginners" (new), Davis on Mounting, and Bausch's manipulations of the Microscope. All in neat box with lock and key. Price \$50.

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FOR SALE—A very good microscope; monocular, with case, eye-pieces and objectives, all being as good as new. Will sell at a good bargain; full particulars given. Address (Correspondence solicited.)

CHARLES VAN EIFF, 347 Greenwich St., New York City.

WANTED—Standard books on Rotifera, Infusoria, Diatoms, Algæ, etc. Will exchange general scientific and literary works for the above.

JAMES E. WHITNEY, Rochester, N. Y.

FOR EXCHANGE OR SALE—Double-stained Bacillus Tuberculosis slides. Will exchange for histological or pathological mounts.

F. T. MERIWETHER, M. D., Asheville, North Carolina.

FOR EXCHANGE—I have for exchange for mounted slides, specimens of crystallized quartz, microscopic and small, perfect crystals, crystals from one-half to three inches in diameter, crystals containing floating particles, crystals containing cavities, and some containing hornblende. State which you prefer and I will endeavor to give satisfaction.

D. M. FULLER, 154 Hamilton St., Albany, N. Y.

QUEEN'S "Physiological" microscope, complete in case and in perfect condition, with one eye-piece and 1-2 and 1-6 inch objectives and camera lucida. Will sell for \$20, or exchange for a high grade 1-2 or 4-10 inch objective—Gundlach or Bausch & Lomb preferred.

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FOR SALE—A Tolles 1-10 glycerine im. 180°, a Wenhaus Reflex Illuminator, made by Mr. Tolles to use with the above lens, and a Fasoldt Micrometer, 1-5,000 to 1-120,000, all in fine condition and cheap. Best of reasons given for selling. Address

F. J. SCHAUFELBERGER, Hastings, Neb.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,

At 32, 34 and 36 Seitz Block, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 25 Washington Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. Box 583, Detroit, Mich.

No receipt will be sent for subscriptions received unless specially requested.

Specimens for examination should be sent to the *Microscope Laboratory*, 25 Washington Avenue, Detroit, Mich. In all cases the transportation charges on these specimens must be prepaid, and special directions for packing and shipping will gladly be sent upon application.

VOL. VII.

DETROIT, SEPTEMBER, 1887.

No. 9

ORIGINAL COMMUNICATIONS.

THE PRESIDENT'S ANNUAL ADDRESS.

WILLIAM A. ROGERS.

MICROSCOPY is a cosmopolitan science. We may go farther than this and say that microscopy is more cosmopolitan in character than any other science. If I did not believe this to be true, I should not have consented to occupy the honorable position which I now hold by your suffrages, for there are many members of this society to whom the honor more justly belongs by virtue of greater familiarity with the technics of our science. I suppose I am indebted to this expression of your confidence on account of the use which I have made of the microscope as an essential factor in a single line of research.

It is the glory of our science that the microscope supplements nature's vision to such an extent that we can submit nearly every theory, nearly every deduction from experiment, nearly every fact of observation, to the supreme and only test by which a real truth in nature can be established, viz.: through the medium of the senses which we have been endowed by the Creator. It has been said that microscopy has no claim to be regarded as a science and that the microscope is simply an instrumental agent occupying with respect to other sciences a position similar to that which the telescope sustains in its relation to astronomy. A convincing answer to this criticism is found in the fact that the telescope is limited in its

application to a very narrow field of research. Where the telescope answers a single question the microscope answers a thousand. Spectroscopy has become a recognized science, not so much because of its revelations in regard to the nature of light, as on account of the application of the spectroscope as an instrument to the study of the physical properties of matter and of motion not only on the earth but in worlds other than our own.

In discussing the question whether microscopy can be regarded as a science, we must always bear in the mind the fact that a science is only a convenient name for a group of similar laws of nature, and that the term is properly applicable not only to the development of the laws but to their application to the useful economies of life. Thus we have the science of engineering in which mathematical analysis is as much an essential part as skill in mechanical construction. But this analysis would serve no useful purpose if it did not rest ultimately on facts of observation.

The limitations which necessarily belong to a definition of physical science are clearly expressed by Tate in his most admirable treatise on Heat. He says: "Nothing can be learned as to the physical world save by observation and experiment, *or by mathematical deductions from data so obtained.*" Now the microscope as an instrument of research stands unrivaled not only in respect to the precision of the observations made with its aid but also in the universality of its application in furnishing what Tate calls "the data so obtained." Each succeeding year witnesses an extension of the range of its applications. Within a few years, while retaining its claim as an essential factor in scientific research, it has also become a very material aid in many mechanical industries. It is a common impression that the microscope is too delicate an instrument to be used in the ordinary operations of mechanical construction, and that the apparent necessity of using transmitted light for the purpose of illumination is an absolute barrier to any extended employment of the instrument. The latter difficulty is entirely obviated by the use of the opaque illuminator, invented by Tolles, by which a bright metal surface can be examined with the utmost ease, while actual experience has shown that it is by no means necessary that the instrument shall be mounted upon massive piers insulated from surrounding objects. I cannot more forcibly combat this impression than by referring to two cases within my own experience. The Proceedings of the Society of Mechanical Engineers for 1887 contains a description of a method of cutting a screw in which each thread is

made to correspond in pitch with equal subdivisions of a standard yard traced upon a metal bar. The screw for the engine constructed for Cornell University was made in this manner. Professor Anthony has shown that the maximum accumulated error of the screw does not reach 2 mikrons for a limit of 20 inches, while the actual error of any selected point will not reach 1 mikron. This screw was cut in the manner indicated, in the third story of a building occupied by machinery, which produces a decided tremor in every room. It was only found necessary to make the attachment of the microscope to the compound rest of the lathe very firm and to brace the head of the lathe very securely from the floor.

The writer was recently called upon to "level up" the head of a very heavy planer, having ways 18 feet in length. Several days had already been spent in securing as good an adjustment as could be obtained with the aid of a spirit level of special construction. A plank 22 feet in length, 8 inches in width and 2 inches in thickness was set up edgewise beside the plating of the planer, but insulated from it. A groove half an inch wide and half an inch deep was ploughed in the upper face of the plank, and after having stopped both ends, the groove was filled with mercury. The surface of the mercury then formed an invariable plane of reference. The microscope was securely attached to the platen and adjusted for sharp focus upon the surface of mercury at one end. The platen was then moved along until the microscope occupied a position near the other end of the groove. This end was then adjusted by elevation or depression, as required, until the surface of the mercury was sharply in focus. After two trials, it was found that the surface of the mercury was at the same constant focal distance from the microscope as indicated by sharpness of definition. Notwithstanding the fact that extreme care had been taken in the original adjustment by the aid of the spirit level, it was found that as the platen moved toward the central part of the bed, the focus became more and more indistinct, indicating that the central part was too low. The proper elevation was then made at these points by means of heavy set-screws, when it was found that the mercury was sharply in focus under the objective throughout the entire range of motion. As a check upon the accuracy of the adjustment, a surface plate, $84\frac{1}{2}$ feet in length, was now planed, when it was found that the deviation from a true surface did not, at any point, exceed the third part of the thickness of tissue paper. Two facts of considerable importance are to be noticed in connection with this experiment. First, that the time

occupied for the complete adjustment was only 25 minutes; and, second, that during the entire operation, the machinery of the shop was running at half speed.

These and similar observations have led the writer to advocate a more extended use of the microscope in the every-day work of the machine shop. By attaching the microscope firmly to the slide rest of the lathe, the ordinary operation of turning shoulders to a given length, and cylinders to a given diameter can be more expeditiously, more exactly, more economically performed than by the usual method.

It is freely admitted by mechanics that a decided advance in mechanical construction would be made by the employment of uniform measures of length. This can be easily and profitably accomplished in any well regulated shop, employing as many as 50 hands, by delivering from a standard-room any desired unit of length, in the same way as tools are delivered from a tool-room. The expense of a comparator, from which any measure of length could be obtained within a limit of time which would not ordinarily exceed one minute, would not be great. If this comparator were placed in charge of a person familiar with its use, and in a convenient location, any workman could have a Calleper set for him in half the time that would be required in setting it to a scale by the usual method, the precision would be incomparably greater, and absolute uniformity would be secured in every dimension of length employed. The various points to which I have briefly called attention, are to be considered simply as illustrations of the many ways in which the useful service of the microscope may be extended.

On the address in which I am called upon to make this evening, as President of the American Society of Microscopists, I have selected a single application of the microscope in scientific research. I beg to call your attention to the microscope as a factor in the establishment of a constant of nature.

If a bar of metal which has the faces of each end parallel and at right angles to its axis, is submerged in melting ice, the perpendicular distance between the two faces may be said to represent a definite unit of length at the temperature of 32° F or of 0° C. If this distance is identical in length under similar conditions with a certain bar of platinum now deposited at the International Bureau of weights and measures at Bretenie, near Paris, and designated the "*Metre des Archins*," the length of the bar said to be one metre. If now the bar is submerged in a liquid which has throughout its entire

mass a temperature one degree higher than that of melting ice, its length, after it has reached the same temperature as the liquid, will be increased by a certain fraction of its entire length. If this length is subdivided into one million equal parts, and if the increase is, for example, ten parts in one million, the coefficient of expansion of the metal is said to be ten mikrons. If the increase in length proceeds uniformly for each and for every incurment of temperature, we can say, for example, that the length of the bar at 100° C will be 1000 mikrons, or one millimeter, greater than it was at 0° C. We can also say that if the temperature of the entire mass of metal is again reduced to 0° the length of the bar will be exactly the same as it was before the increase of temperature took place.

There is some evidence that when certain metals are exposed to very violent changes in temperature, as when zinc is removed from a temperature of 100° and is submerged in melting ice, the molecular arrangement of the metal is disturbed to such an extent that the return to its original condition may be delayed for several days, and for several weeks; but it cannot, at the present time, be positively asserted that the return will not entirely take place.

It will be noticed that the definition of the coefficient of expansion which has been given, viz: the increase to an increase of temperature from 0° to 1° , contains the important limitations that the entire mass of the metal shall have reached the temperature of 1° .

OBSERVATIONS ON A NEW DASYDYTES AND A NEW CHÆTONOTUS.

DR. ALFRED C. STOKES.

THIRTY-SIX years ago (1851) in the *Annals and Magazine of Natural History*, Mr. P. H. Gosse published a short diagnosis of a little aquatic animal allied to *Chætonotus*, but differing so widely from that well-known microscopic creature that a new genus was needed for its reception. This genus Mr. Gosse formulated concisely and gave it the name *Dasydytes*, from the Greek *dasus* hairy, and *dutes* a diver, at the same time describing two species. The diagnoses of all were so extremely concise that I quote them here: "*Dasydytes*. Eyes absent; body furnished with bristle-like hairs; tail simple, truncate." Of the two species the descriptions are: "*D. goniathrix*. Hairs long, each hair bent with an abrupt angle; neck constricted. Length $\frac{1}{148}$ inch.—*D. antenniger*. Hairs short, downy; a pencil of long hairs at each angle of the posterior extremity

of the body; head furnished with two club-shaped organs resembling antennæ. Length $\frac{1}{170}$ inch." From 1851 up to 1876 *Dasydytes* received no further attention; it was not even seen, so far as I know. Then Ludwig in *Zeitschrift für wissenschaftliche Zoologie*, for 1876, republished Gosse's diagnoses. Further than this the little creatures, so far as I am aware, have not been even referred to, except by the *Micrographic Dictionary* which also only reprints Gosse's concise descriptions; and if either of the species from English waters has been seen since their discoverer first found them, there is no record to that effect. No illustrations were published by Gosse nor by Ludwig; and no supplementary observations have been offered in reference to structure, habits or development. The newly-discovered animals were at the time classed by Gosse among the Rotifers. They belong, however, in the group with *Chaetonotus*.

More than a year ago it was the writer's good fortune to capture a single individual of an undescribed species of *Dasydytes*, the first, so far as known, to be observed in this country. At the time, its structure was not entirely mastered; and although I have recently taken others of the species from the same locality, I fear that the description must still be somewhat incomplete, as the little creature is peculiarly difficult to study.

In form the species referred to bears a remote resemblance to *Chaetonotus*, differing in its shorter body, the presence of a more distinctly formed neck, and in the absence of the furcate posterior extremity. The colorless and transparent body is irregularly ovate, and less than three times as long as broad. Its internal structure is not very widely different from that of *Chaetonotus*, but in general appearance the animal lacks the graceful form and attractive movements of the latter. The absence of the two tail-like prolongations so conspicuous in some of the *Chaetonoti* detracts from the beauty of *Dasydytes*, its posterior extremity being simply rounded or convexly truncate; and its movements are much less smoothly gliding and facile. The habitat of both animals is the same, being chiefly near the bottom of shallow ponds, although, if the surface be covered with *Lemna*, both will probably be taken with those plants whose lower surfaces they search for food, or in whose abundant rootlets their little bodies may become entangled.

The head of the present species, and presumably of all, is flattened and distinctly three-lobed, the anterior lobe being the smallest and least rounded and bearing on the frontal border a colorless, apparently chitinous plate or cephalic shield. Both surfaces of the

head are ciliated, the cilia being very long and fine. They are arranged in two transverse or encircling series, those of the anterior extending backward, while those of the posterior project anteriorly and habitually vibrate in that direction. The lateral lobes are merged into the constricted region which forms a conspicuous neck-like part and equals or exceeds in length that of the head. It is movable and extremely flexible, the *Dasydytes* continually bending it from side to side in the search for food, or lifting it upward or flexing it toward the ventral surface. It can not be rotated; so far as I have seen rotation is accomplished only by a partial revolution of the whole body. The movement of cervical flexure is made chiefly when the *Dasydytes* throws the body on the back, almost invariably turning this somersault by flexing the neck under the ventrum and lifting the rest of the body forward. The feat is seldom performed, and the position is retained for a short time only, thus making a study of the ventral surface prolonged and tedious, as the observer can have only the most momentary and unsatisfactory glimpses at its appendages.

The body proper is ovate, the dorsal surface convex and the ventral flattened. From each side of the anterior region near the base of the neck, from each shoulder, if I may so express it, there arise from four to six large, bristle-like setæ, each of which equals or exceeds the entire animal in length. These appendages originate at equal distances apart on the lower surface of the lateral borders, arch upward above the dorsal region, the group on the right-hand side extending above the body and obliquely backward toward the left-hand border, while the sinistral cluster, originating in the same way on its side, extends similarly toward the right-hand margin, one group crossing the other above the postero-dorsal region, and both projecting obliquely for a considerable distance beyond the rounded extremity of the body. (Fig. 1.) The setæ are most robust at their points of origin, near which they usually exhibit an irregularly sigmoid curvature, thence tapering and evenly curving, without abrupt bends or any signs of furcation, to their distal extremities. They seem to rise directly from the body without the intervention of a plate, scale or cuticular thickening of any kind. The *Dasydytes* can slightly separate those of each cluster, but further than this I have not observed that it has any control over them. Occasionally they are to be seen extending irregularly along the animal's sides, thus giving it an untidy and disheveled appearance, but whether or not this arrangement is voluntary I do not know. What their function

may be does not appear. They are probably tactile, and, it may be, protective. Without them the dorsal surface would be naked, except for the presence of two fine, almost vertical, tactile hairs on the posterior region, each of these arising from a minute papilla near the lateral borders.

The ventral surface is usually and obstinately kept in contact with the submerged object, or at least directed toward the surface above which the animal is swimming; the part is therefore not easily examined, as the observer must wait until the animal thinks it proper to turn on its back, a position it seems to dislike, for the evident reason that it has four springing setæ on the ventral surface, by whose action it makes some surprising leaps. It is not possible to reverse the slide, as the thickness of the glass forbids the use of the high-power objective needed, for this *Dasydytes* is only $\frac{1}{300}$ inch long, an $\frac{1}{8}$ th inch objective being necessary for its study.

The ventral cilia are long, fine and comparatively few in number. They are in two bands extending longitudinally near the lateral margins, essentially as in most species of *Chaetonotus*. The central region between the bands appears to be clothed with short, fine, immotile setæ, a somewhat similar arrangement being also present in several forms of *Chaetonotus*. Near the centre of this region of the body proper there originate four setæ, two long and two short, the longest much exceeding the whole animal in length, the setæ of both groups projecting far beyond the posterior body-margin. They originate as do the dorso-lateral appendages, directly from the cuticular surface, and have the irregularly sigmoid curvature near the base. These are the springing setæ already spoken of, and their elbow-like basal curvature is the only unevenness in any part, the portion beyond it tapering gradually to the end.

The evenly swimming movements of *Dasydytes* are somewhat more rapid than those of *Chaetonotus*, but the former has the additional ability to suddenly leap to one side, by means, as I suppose, of these long ventral setæ, often unexpectedly jumping to a distance exceeding twice its own length, and disappearing from the field. For this reason I have named the species *Dasydytes saltitans*, sp. nov. The leaps are made so suddenly that the exact method is invisible. They are probably accomplished, however, by the movement of these four setæ, together or separately, the leap being caused by the recoil and the reaction of the water.

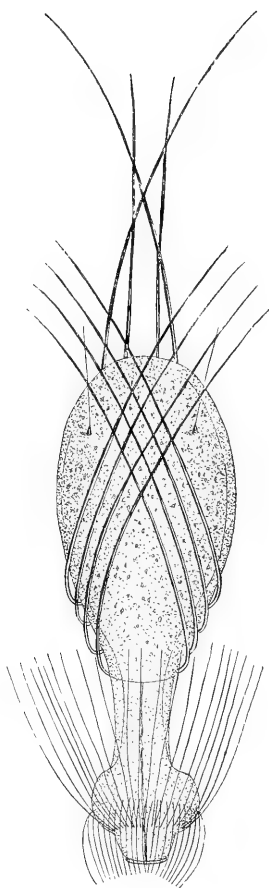


PLATE VI.

The oral aperture is nearly apical. It is surrounded by an annular elevation, and apparently ciliated, essentially as in *Chaetonotus*. The nearly straight and extremely muscular œsophagus is triangular internally when not expanded, the organ extending through the head and neck to terminate in the digestive cavity, a large, ovate, sac-like part almost completely filling the body-region proper. The œsophagus has a snapping movement similar to that of the same part in *Chaetonotus*. The food is engulfed by suction, comparatively large and living infusoria and organic particles being equally acceptable. When the food enters the anterior part of the œsophagus it is urged backward and forward several times as if it were being tested before being accepted. Above and on the sides of the digestive sac is indistinctly visible what I take to be the ovary. The egg I have not seen in any stage of ovarian development.

Recently in a shallow wayside pool, swimming among conifer-void algæ I have abundantly found a beautiful and undescribed species of *Chaetonotus* which I have named *Chaetonotus formosus*, sp. nov. The dorsal, lateral and ventro-lateral aspects are clothed with short, fine, recurved setæ arranged in quincuncial order, and each rising directly from the cuticular surface, with a slight basal enlargement, but without the intervention of scale-like thickenings. These setæ are all sub-equal in length, measuring $\frac{1}{50}$ inch or less, those on the head and neck being somewhat stouter than those on other parts. The head is tri-lobed, the lateral lobes being prominent and rounded, the anterior one flattened frontally and bearing a small plate or cephalic shield. The flattened ventral surface bears two ciliary bands, the intervening surface being hispid with fine, recurved setæ. The cilia about the oral aperture are chiefly as in other forms, and the oral annulus is minutely monilated. The caudal glands are usually distinct, often conspicuous. The length of the animal is $\frac{1}{150}$ inch.

The little creatures were plentiful in the shallow pool where they were until the water dried away under the warmth of the sun, and although the majority contained an ovarian egg, often two, I failed to witness the extrusion, or to find one in the mud or among the algæ; neither could I keep the animals alive long enough in a life-slide to mature the ovum. This I much regret, as so attractive a form should have an unusually well-ornamented egg.

TRENTON, N. J.

INSECT PREPARATION.

SECOND PAPER.

B. F. QUIMBY.

SINCE the writing of the first paper, some experiments with the hypodermic syringe have shown its use in the arrangement of the membranous wings which often become so twisted that they cannot be brushed out and are very liable to be broken in the attempt. Removing the insect on the glass slip from the water, the syringe may then be used in throwing streams over and under the wings; thus untwisting and spreading them out, using the brushes at the same time: one in holding the insect in position and the other to aid in the adjustment.

An effective way to direct a stream under a wing is to pass the needle under the insect so that the orifice may be where the wing joins the body, thus the out-flow will be lengthways of the wing. The syringe may be made very useful in other ways in the process of cleaning.

MOUNTING.

Remove the insect from the oil of cloves and place it in turpentine contained in a solid watch-glass. Our purpose in doing this is to remove the surplus of cloves, which will interfere with the subsequent hardening of the balsam. Place the watch-glass on the plate-glass of the dissecting-box illuminated and examine the insect carefully. If any dirt is found it may sometimes be removed, if on the outside, by brushing. Use two of the brushes not used in previous cleaning processes. To make sure as to the condition of the insect, place the watch glass on the stage of the microscope and examine.

Having ready a glass slip and cover-glass of suitable size, both carefully cleaned, adjust the glass of the mounting-box placed in such position that the under illumination may be best reflected into the cupola-like top bearing a slip of glass having upon it a colored centering ring, on which place the slip to be used for mounting the insect.

Then using the medium-dropper, put only enough Canada balsam on the center of the slip to spread out under the whole insect when placed in position. With pliers draw the insect carefully out at one side of the watch-glass, draining off the turpentine and avoiding as much as possible deranging the wings. Then with care drop the insect on the balsam prepared on the slip. Let the contact be at one end of the insect, lowering gradually to avoid making bubbles which

if underneath, cannot easily be removed. Rather than attempting their removal, return the object to the turpentine and repeat the process with more care. If any arrangement of the parts may be required, use the mounting pair of brushes, dipping them at first and occasionally after in the turpentine to avoid creating bubbles which however may, if on the surface, be readily broken by using the point of a needle heated in an alcohol flame. Then apply more balsam over the insect, wipe the under side of the cover glass, held with the pliers in the turpentine, draining off as much as will, then place the cover-glass over the insect, having regard to the centering ring. It must be lowered first at one edge of the cover-glass and slowly to avoid making bubbles which are not so likely to appear if the balsam is of proper consistency. The moistening of the cover glass also obviates that tendency. It will now be usually found necessary to make some readjustment of the parts or position of the insect. This is often a most trying process; but may be accomplished with the flattened needle referred to. Holding the pliers perpendicularly, rest on the slip the points spread to span the edges of the cover-glass to hold it in place. Then moistening the needle in turpentine, insert it under the cover-glass and move the insect as desired. For this process the great advantage of having the slip raised on the cupola of the mounting-box with under illumination will be appreciated. The utmost tenderness of movement with the needle is required to avoid injury to the delicate parts and creating those old enemies the bubbles. We may now press the cover down and remove most of the surplus balsam by the suction of the medium-dropper.

The previous processes have so flattened the insect that pressure by weight or slip on the cover will not usually be needed.

The troublesome adjustment with the needle under the cover may be avoided if the insect when placed on the slip adheres closely in all its parts, without tendency of the wings to curl or other parts to project out of the balsam. It may, after proper arrangement, be put aside under some cover, to exclude dust, until the balsam has so hardened that fresh balsam may be applied and the cover-glass put on without disturbing the arrangement.

Pure benzol is in some respects better than turpentine in the mounting work; but is expensive. As good results can probably be had with turpentine.

The slide may now be put away for the balsam to dry and harden, which may be much accelerated by moderate heat. For this purpose the drying-box described in the catalogue of W. H. Walmsley & Co. is unsurpassed.

In drying, air spaces will often appear at the edge of the cover-glass. Applying balsam will fill these spaces.

Without heat, three or four weeks must elapse before it will be safe to clean the slip. Most of the surplus balsam may be removed with a knife blade heated in an alcohol flame. Chloroform on a handkerchief will quickly remove the remainder; but the chloroform softens the balsam about the edge of the cover, therefore do not dwell long in this process. but put the slip away to reharden, after which make a final cleaning by the use of soap suds and a soft brush, rinsing after with water and wiping with a handkerchief.

The completion of an insect mount may be hastened by cleaning off the balsam two or three days after mounting, using chloroform with great care as to disturbing the cover-glass, then placing the slip in a turn table, apply several coats of shellac dissolved in alcohol about the cover-glass, giving time for each coat to dry, which it will quickly do.

This of itself will be a nice finish; but if desired the shellac ring may be covered with white zinc cement in the usual way. On this circle fine colored lines may be made with a small brush, using Canada balsam which has been tinted with any desired color of tube oil paint thinned with benzol.

The circle of shellac will prevent the subsequently-applied white zinc cement from running under the cover, which would certainly happen if the shellac were omitted. It may be trite to add that in insect preparation as in all microscopical work, the utmost cleanliness should be observed and dust avoided as much as possible. For this purpose it is best not to have a woolen carpet in the work room. Some of its dust will be sure to appear in the mounted slide.

Some interesting insects are too large for ordinary 3 x 1 in. slips. For these can be obtained 3 x 1½ in. slips from the Palmer Slide Co., Geneva, N. Y., with covers round or square to match. This company, for a very reasonable charge, will grind the edges of covers, thus enabling a nicer finish.

MOUNTING INSECTS AS OPAQUE OBJECTS.

In this work none of the preceding processes of preparation are required. The most to be done is in providing a suitable cell, which is quite fully explained in the text books. It is desirable to have a good, dark background on which to place the insect. This may be made by brushing a coat of water-color lamp-black on the bottom of the cell. When dry, put in a drop of Asphalt cement, on which place and press down a cover-glass small enough to go inside the cell. On

this quite opaque and black bottom of the cell, attach the insect in proper position by means of the paste referred to, and place some light weight on the insect to hold it down until the paste is dry.

Fresh insects are more pliable to put in position, but if used, the slip must be put away until the object is quite dried, otherwise there will be formed on the inside of the cover-glass a film which will obscure the view. When dry, place the slip in a turn-table and apply a thin ring of cement about the top of the cell, on which place and press down the cover-glass evenly adjusted to the rim of the cell and not so large as to project over. When the cement is hardened three other thin coats may be added, having care that each coat is dry before the next is applied. As cements, by evaporation, so quickly become thickened, there is a tendency to use them of such consistency as not to flow freely, hence the work is not smoothly done.

If the first coat is not quite dried and too thick coats follow, the cement is liable to run under cover.

For adhesiveness, durability and beauty of finish, white zinc cement will, if properly used, be found quite satisfactory.

For labeling slides a very good paste is made with dextrine mixed in camphor-water to the consistency of ordinary mucilage, to which paste is added about six drops of glycerine to the fluid ounce. If this should tend to mold add two or three drops of carbolic acid.

The processes described in these papers are not claimed to be to any considerable extent original; but are such as the writer has found most satisfactory after some years of amateur experiment. There are readers of THE MICROSCOPE who can doubtless suggest some improved methods. If they will do so, then more benefit will result to those working in this line than anything herein set forth.

CHICAGO, ILL.

PROCEEDINGS OF SOCIETIES.

AMERICAN SOCIETY OF MICROSCOPISTS.

THE opening session of the tenth annual meeting of the American Society of Microscopists was called to order by the President, Prof. William A. Rogers, at eleven o'clock, Tuesday, August 30th, in the chapel of the First Presbyterian Church, Pittsburg. Had the roll been called, probably not more than twenty-five or thirty members would, at that time, have answered to their

names, but by the second, or the beginning of the third day, more than seventy-five were present, besides a number of visitors. The place of meeting was well chosen, being quite central; the room spacious, light and airy, and the sittings comfortable. After the call to order, C. C. Mellor, Esq., President of the Iron City Microscopical Society, offered a few remarks, and was then followed by B. C. Jillson, Ph. D., who, in behalf of the city and the local society, presented an address of welcome. Mr. Jillson briefly reviewed the growth and work of the Iron City Microscopical Society, which owed its birth, about five years ago, to a few gentlemen interested in the subject, and who, at that time, formed a union for microscopical research in and about Pittsburg. From this nucleus the society had taken on a rapid growth, and was now in a flourishing condition. Although, as yet, no particularly scientific work had been accomplished, the speaker was greatly in the hope that the future had a useful place in store for this society. The various scientific institutions of Pittsburg were then spoken of, and the visiting microscopists urged to avail themselves of this opportunity to inspect them.

The cordial welcome given was responded to by President Rogers, who pointed out the aim of the American Society, and the advantages to be derived from membership by all interested in microscopical research. In closing his remarks, Prof. Rogers strongly urged young men who take interest in scientific truths, to connect themselves with the Society.

The Rev. John Fox then offered the prayer, invoking the Divine blessing upon the work and session of the Society.

Prof. Kellicott, for the executive committee, then read several recommendations. Among these was a motion to rescind by-law No. 7, which was ultimately carried.

In announcing the deaths which had occurred in the society during the past year, Prof. Rogers mentioned the names of Dr. A. Y. Moore, Mr. Bernard Persh, and Dr. Blaisdell. An elaborate sketch of Dr. Moore's early life and training was, by special request, then read by Mr. C. M. Vorce.

Dr. R. H. Ward then offered a few remarks on a method of producing a standing image with binoculars.

In the afternoon Dr. Frank L. James, of the *St. Louis Medical and Surgical Journal*, gave the history of his methods of crystallization by cold, and the manner in which he produces his wonderfully beautiful salicin and other slides. (See THE MICROSCOPE, p. 166, of this volume).

Prof. Simon H. Gage stated the results of his inquiries from various makers, both in this country and abroad, as to what they meant by the so-called "Tube-length," and the thickness of cover-glass for which unadjustable objectives are corrected.

Prof. D. S. Kellicott followed with abstracts of two interesting papers. In the first of these he defended his position in regard to the *Floscularia millsii*, which had been thought by Mr. Gosse to be the *F. ichornia*. In the second paper dealt with some new and rare infusoria. Then came papers on Apochromatic objectives, by Ernst Grundlach, read by Mr. Turner; observations on the effect of powerful electric currents on the tissues of animals, by Geo. E. Fell.

After the usual announcements the society adjourned to visit the establishment of Mr. Jno. A. Brashear, where the method of making telescope lenses, etc., was fully explained by the ever-ready and genial host. Prof. Very, at the observatory, explained the methods of their astronomical work, and the instruments used in accurate observation.

In the evening President Rogers delivered the annual address, which was listened to by a large and appreciative audience.

Wednesday morning, Aug. 31, was devoted to the following papers: Cements and Waxes, by W. H. Seaman; Diseased germs, which was another illustration of the fact that bacteria cause disease, by T. J. Burrill; the Bacillus of Foot-rot in sheep, by Mark Francis, read by Dr. H. J. Detmers; Method of estimating the number of Trichinæ in meat, by S. H. Gage; Ending and relation of the muscular fibres in the muscles of minute animals, by Susanna S. Phelps Gage. This important paper deserves especial mention for the care and conscientious work which the author has put upon a subject long overlooked.

A very curious microscope, once the property of Limæus, was described by C. C. Mellor.

The following committee on nominations was elected: Dr. S. M. Mosgrove, George H. Clapp, F. L. James, Dr. W. P. Manton, Dr. George E. Fell, C. C. Mellor and Dr. W. J. Lewis.

In the afternoon the society embarked on the pleasure steamer Mayflower for a visit to Braddock, where are located the Edgar Thompson steel works. At the dock an engine and three cars were in waiting and the party rode along the ravines, through mountains of slag and cinder, up into the middle of the great Bessemer plant. Here they were met by several of Mr. Carnegie's lieutenants, who at

once led the party up to the colossal iron furnaces, from which the slag was just being drawn off, and torrents of fire poured down through the sand like streams of lava on the sides of a volcano. The seven different furnaces were then visited and finally the steel converting department. Here there was also a great surprise in store for the microscopists in witnessing the ease with which great masses of fiery steel were handled with the hydraulic machinery. From the converting mill the party next went down and watched the ingots pass through the three high rolls and come out in the shape of steel rails, at the rate of over a thousand tons a day. Several hours were spent in going through the different departments of the works and the party saw the entire phenomena of making a steel rail from the time that the ore was unloaded from the car, mixed, passed through the iron furnaces, the rolls, and ultimately came out ready to be laid on one of the great thoroughfares of the world.

At 5 o'clock the party returned to the boat and the journey homeward began. Soon after the steamer was headed down stream, President Mellor, of the Iron City Society, announced that a working session would be at once inaugurated on the main deck with some excellent specimens for examination. Upon going downstairs an excellent lunch was discovered, and the party fell to with an appetite that required no stimulation from microscopic apparatus. The trip down the river was a most enjoyable one, and the day was spent most pleasantly in reviewing the incidents of the trip and comparing notes. It was 7 o'clock when the boat reached the Water street wharf. Later in the evening an informal reception was held at the Monongahela House, the headquarters of the society. In one of the parlors Dr. McIntosh, of Chicago, showed the working of his lantern by projecting microscopic plants on to a screen. Other members engaged in inspecting lenses and resolving amplipleura fustules, or exchanged notes on microscopical methods.

Thursday, Sept. 1st. In the morning the papers read were: Some easy methods of testing photographic lenses, by Henry B. Turner; the Comparative size of blood corpuscles of man and domestic animals, by Miss Freda Detmer, read by Dr. Detmer. A microscopical slide cabinet, by R. H. Ward; the Tape-worm, methods of preparation for the museum and the microscope, by J. M. Steadman, read by Mr. Sargent; a description of *Ergasilus Chautauquaensis*, and a list of other entomastraca found at Chautauqua Lake in August, 1886, by C. S. Fellows, read by Prof. Lester Curtis. In the afternoon,

THE WORKING SESSION

was held at the chapel, the several alcoves of the room gave ample and convenient space for the various demonstrations of technique. The work of arranging the session devolved upon Prof. Kellicott, he being the only member of the committee present. With his duties as Secretary of the society, he was overburdened.

The time allotted to the session, from 2 to 4 p. m., was too short. The proper study of methods demands a few hours, something more than a hasty glance and a question, to be of value, more time should be given for a deliberate exposition of the details. Several exhibitors, who brought complicated apparatus, hardly had it arranged in working order before the members were called away by the reception committee. This is too important a feature of the meetings to be slighted, and the committee having it in charge in the future should look to it that nothing encroaches upon its allotted time. Still, some excellent practical demonstrations were made. Messrs. H. R. Spencer and E. K. Buttles showed the method of collar correction for immersion objectives, and the measurement of the angle of aperture of objectives. Dr. Frank L. James gave lessons in the care of microtome knives, and tried to teach his audience to prepare glycerine mounts, after his own perfect manner. Professor Simon H. Gage demonstrated a method of preparing areolar tissue. Mr. Charles Wellington and Mrs. Wellington cut, ground and mounted favorite hamiltonia, etc. J. J. B. Hatfield cut, stained and mounted vegetable sections. Dr. R. H. Ward illustrated his method of erecting the image in binocular microscopes. Dr. L. D. McIntosh showed his solar apparatus, and his electric light for use with the microscope. Drs. W. P. Manton and C. G. Jennings demonstrated the methods of embryological research with the incubator oven, etc., from THE MICROSCOPE laboratory.

Dr. James E. Reeves, assisted by Miss M. A. Spink, imbedded specimens by the interstitial method and revealed the secrets of his beautiful mounts.

Mr. W. A. Drescher cut imbedded and frozen sections with the Bausch and Lomb microtome.

Mr. C. M. Vorce revealed the sophistications of some food products.

Prof. W. H. Seaman demonstrated the method of producing crystallization of chemicals.

Mr. R. N. Reynolds, Mr. Frank F. Colwell and Mr. J. H. Logan demonstrated various methods of mounting.

The Soiree, held in the evening at the old City Hall, was a marked success. The arrangements by the local committee were excellent and the great crowd of over 3,000 spectators were shown the beauties of about one hundred and twenty objects without the slightest confusion. Nearly all of the members present at the meeting were among the exhibitors. The people of Pittsburg were given an excellent exhibition and appreciated it.

Friday, September 2d. Mr. Wm. J. Lewis, Chairman of the nominating committee, presented the following names for ballot:

For President, D. S. Kellicott; 1st Vice-President, J. H. Detmer; 2d Vice-President, T. B. Stowell; Secretary, T. J. Burrill; Treasurer, S. M. Musgrove; Executive Committee, R. J. Munn, C. C. Mellor, H. D. Kendall.

These gentlemen were then elected by ballot.

The following papers were read: The fallacies of bacteriological research, by Geo. W. Lewis, read by Dr. George E. Fell. The Life History of the Diatomaceae, part II., by H. L. Smith, read by title. A new photo-micrographic camera, by Geo. W. Rafter, abstract. An interesting study of the cardiac muscle cells in man, and certain other mammals, by B. J. Oviatt, was read by Prof. Gage. The session closing with a few remarks on the Zeiss' apochromatic objectives, by H. J. Detmer and others.

The programme for the afternoon embraced the following list of papers, several of which were read by title or abstract: Comparison of Fasoldt, II., with centimeter scale "A," by M. D. Ewell; erysipheae of Illinois, by T. J. Burrill; Notes on microscopical exhibitions, by R. H. Ward; Permanent Potassium hydrate preparations, by Boardman J. Oviatt.

After the usual business and reports, the tenth annual meeting of the American Society of Microscopists was officially declared adjourned.

No attempt has been made to give more than an outline of the programme offered, but the mere mention of titles is sufficient to indicate the high class of papers read, and the real work done by the society. During the session the Spencer-Tolles' fund received several subscriptions, and by vote of the Society it was decided to devote the interest accruing from this money to the assistance of some student in carrying out original research. Although the attendance at this annual meeting may have fallen a little short of that expected, those who were fortunate enough to be present left Pittsburg with a feeling of satisfaction, and with an increased determination to advance the interests of American microscopy and the A. S. M.

THE SAN FRANCISCO MICROSCOPICAL SOCIETY.

A WELL-ATTENDED meeting of the San Francisco Microscopical Society was held June 8, 1887, at its rooms 120, Sutter street, President Wickson in the Chair.

The committee having in charge the late reception submitted its reports, showing said occasion to have been the most successful affair of the kind ever held on this coast, not only in extent but also in quality of instruments and of objects shown.

An ingenious device, called the "Quimby Mounting Cabinet," was received for inspection from the society's indefatigable corresponding member, E. H. Griffith. Its purpose is to facilitate the illumination of objects by transmitted light, during the process of mounting, and this object is very satisfactorily attained by the apparatus referred to, both by daylight and artificial light.

Dr. Selfridge brought a sample of the Oakland water supply, which upon examination was found to contain large numbers of the interesting infusorian, *ceratium longicorne*. Some four years ago the water supply of this city contained enormous numbers of the same little organisms.

Mr. Wickson exhibited some eggs and insects found upon an apple tree by Dr. Edward Gray, of Benicia, and sent by him to the society for determination. Mr. Wickson remarked that it would be difficult to identify a species by the egg and newly-hatched larvæ alone, unless one is very familiar with the forms. He said, however, that the insect was of the *heteroptera*, a sub-order of division of the *hemiptera*, in which one pair of wings is thin and membranous and the other partly thickened and leathery. The *heteroptera* are divided into twelve families and the specimen sent probably belongs to the *scutelleridae*, a family characterized in part by the size of the shield it bears upon its back. The larvæ shown had neither wings nor shield: these parts appear later in the progress of the insect. The eggs shown were strikingly beautiful. They were oval in shape, attached to the bark by one end, while the upper end was either open—if the insect had hatched out—or still closed with its cap-like cover, if the larvæ had not appeared. The eggs are of pearly hue and had the appearance of frosted glass-ware. In the mouths of the eggs from which the larvæ had hatched there was to be seen the following peculiar arrangement, described by Kirby and Spence: "The egg of a *Pentatoma* is furnished not only with a convex lid, but with a lever of a horny texture, and in the form of

a cross-bow, for opening it, the handle being fixed to the lower part of the egg by a membrane and the bow part of the lid. When the larvæ is ready to emerge the cap flies off the egg-case. In the specimens shown under the microscope some of the covers were shown as they had fallen off and were lodged on the bark. The eggs, etc., had been mounted by Mr. Wickson in a deep cell, which, although very simple, answered the purpose admirably. It consisted of the neck and top flange of a homeopathic vial, the lower edge having been ground flat and cemented to the slide.

June 22, 1887. Series 2 and 3 of Walker & Chase's "New and Rare Diatoms," consisting of photo-engravings of interesting forms, with descriptive text, were donated by Dr. H. H. Chase.

A communication was received from A. J. Doherty, of Manchester, England, the well-known preparer of microscopic objects, announcing his intention of visiting this city in a few months. Arrangements have been made with him for a series of demonstrations of the most approved methods used in the preparing and mounting of objects for the microscope, and from the admitted ability of the gentleman in this line his discourses cannot fail to be interesting and instructive. A series of slides mounted by him and comprising a wide range of subjects, were shown under a number of microscopes last evening by J. G. Clark, and the excellence of workmanship shown by these mounts, elicited the warmest commendation.

The useful little device known as "Griffith's Focus Indicator," was shown by Mr. Riedy. Its object is to enable an approximate focus to be obtained almost instantly, and to prevent the accidental crushing of a slide or cover-glass by the objective, in focussing.

Mr. Norris announced that through the kindness of Mrs. Ashburner he had come into the possession of a number of exquisite slides, mounted by the late Prof. Ashburner, and comprising a number of preparations of the celebrated "original Santa Monica" find. No better disposition could be made of these, Mr. Norris thought, than to distribute them among the members of the Society, and this he proceeded to do. As appropriate mementoes of a departed friend, as evidences of his rare skill as a microscopist, and as the last remaining examples of mounts from the remarkable fragment whose history has been so closely connected with that of the Society, these slides will be considered treasures by their fortunate possessors.

Specimens of rich diatomaceous earths from near San Pedro, and from near Santa Monica, collected by Mrs. Bush, of Santa José, were also handed in by Mr. Norris.

A. H. BRECHENFELD, *Rec. Secretary.*

ST. LOUIS CLUB OF MICROSCOPISTS.

THE oppressively warm weather did not prevent the members of this club meeting Tuesday evening, August 2, and holding a very successful session. Specimens were exhibited by Mm. Ilhardt, Otto Meyer, J. C. Falk, E. T. Jester, A. J. Hoenney, Frank Davis, and others. Among the objects examined were samples of pure powdered drugs and spices, vegetable histological specimens, etc. Professor H. M. Whelpley gave a short illustrated lecture on polarized light.

The club is collecting quite a cabinet of interesting specimens, and intend to give a public entertainment this fall. The next regular meeting will occur Tuesday evening, September 6.

ELEMENTARY DEPARTMENT.

SEVENTH LESSON.

“CLEANLINESS IS AKIN TO GODLINESS.”

MOUNTING-MEDIA.—Canada balsam is the one mounting-medium thus far employed in the working of these lessons when a permanent preparation is desired. In the writer's experience it is the only one which insures comparative permanency, and should be used in preference to all others when admissable. Yet there are occasions when a different medium will be found necessary, such, for example, as in the mounting of fresh tissues or when stains have been employed which would be injured by the balsam. All necessary media for use in preparing animal tissues will be found among those here described.

CANADA BALSAM.—The commercial balsam can be used without further preparation, but, as it is very viscid, the addition of some thinning agent, as suggested in the Fourth Lesson, page 172, will be found advantageous. Chloroform or benzol may be used for this purpose. Chloroform is rather better, as balsam prepared with it does not shrink so rapidly, thus avoiding vacuolations under the cover-glass. When, however, it is desired to mount objects stained with the anilin colors, benzol is to be chosen, as it does not act so destructively on these dyes as chloroform. A somewhat more elegant preparation can be made by first heating the balsam over a water-bath. This frees it from the turpentine and leaves it as a brittle mass. This is then to be dissolved in chloroform, filtered and kept in a

closely-stoppered bottle. Balsam thus prepared is of a lighter color, hardens somewhat more rapidly and does not become so much discolored on exposure to light; though in a mount, even with the extemporaneous mixture, years are required to bring about this discoloration.

DAMMARLACK.—This gum comes in hard, friable masses and may be prepared like the balsam by dissolving in chloroform or benzol. It makes a beautiful, colorless medium, thus making it valuable for photo-micrographic work; but is unfortunately not permanent. In several hundred specimens mounted in this medium by the writer some ten years ago, fully two-thirds were found destroyed by a cloudy, granular precipitate. The remaining one-third are in a tolerably good state of preservation. A good preparation of dammar recommended by Gibbes may be made as follows:

1. Gum dammar..... $\frac{1}{2}$ ounce.
- Turpentine $1\frac{1}{2}$ ounces.

Pulverize the dammar and dissolve in the turpentine, and filter.

2. Gum mastic..... $\frac{1}{2}$ ounce.
- Chloroform..... 2 ounces.

Dissolve and filter.

Mix the two solutions, filter again and keep in close bottles. A little of this may be kept in a dropping-bottle for use. If it thickens from evaporation a little chloroform may be added. This preparation, however, is not permanent.

Dr. F. L. James in his excellent little work "Elementary Microscopical Technology," recommends a preparation of dammar, which, he thinks, will prove permanent in character. It is made as follows: "To the clarified solution in benzol (which is made by dissolving the gum in sufficient benzol to make it thin enough to pass through a filter-paper) add alcohol of 90° until a precipitate is no longer formed. Remove the precipitated gum and wash with distilled-water and afterwards with alcohol; let dry thoroughly and redissolve in pure benzol. This resin, when dry, is exceedingly brittle, falling into an impalpable white powder upon the slightest pressure. The addition of twenty drops of poppy or nut-oil, while imparting a faint yellowish tinge, corrects the brittleness."

GLYCERIN.—When the use of resins is inadmissible, glycerin, pure or in combination is almost universally employed. Indeed, some microscopists prefer it to balsam. For use in animal histology, however, the writer does not favor it. Tissues preserved in it do not

have that clear-cut appearance nor are the colors so bright and firm as those observed in balsam mounts. Then it has great avidity for water and does not harden, which necessitates the sealing of the cover-glass. This sealing if not done in the most perfect manner will admit of the entrance of moisture with a consequent destruction of the mount. Granting it well done, the writer has doubts that even pure glycerin acts as an indefinite preservative, though others far more experienced in its use hold to the contrary.

For temporary use, as in the inspection of sections to determine their value for permanent preservation in balsam it is excellent; for the specimen can be taken directly from the water in which it has been washed after staining, quickly examined, and if found acceptable, can then be rewashed and put through the usual course.

To obtain the best results pure glycerin should be employed, though if its syrupy condition interfere, a little distilled-water with a few drops of acetic acid can be added. The addition of these, however, somewhat reduces its preservative quality.

FARRANT'S MEDIUM.—This preparation of glycerin is one of the most eligible, for the reason that though it remains soft under the cover-glass, the gum arabic which it contains causes it to harden at the edges, thus facilitating the sealing process; or, when it is not desired to retain the specimen for any great length of time, to dispense with it altogether. It has the disadvantage, however, of not being permanent, the gum which it contains tending to induce a cloudy, granular condition after the lapse of a few years.

The medium is prepared as follows: Take equal parts of distilled-water, glycerin and a saturated solution of arsenious acid—saturated by boiling—mix well and add about one-half the bulk of picked gum arabic, allow this to stand for two or three weeks, stirring daily until the gum is entirely dissolved. Filter carefully and decant into glass-stoppered bottles. If too much gum is added the medium soon becomes cloudy; if too much glycerin it will not harden as described above.

GLYCERINE JELLY.—Kaiser's glycerin jelly, the formula of which and methods for employing will be found on page 152 of this journal, is an excellent medium and can be used in place of Farrant's medium if desired.

The mounting of all animal tissues, however prepared, can be as well done with the media above described as if the list were larger and more complex. The beginner should carefully experiment with

these, with the exception for the present of pure glycerin, which demands almost immediate sealing. This sealing process will be described in the next lesson, and later the most appropriate uses for the different media will be given.

EDITORIAL.

THE PITTSBURG MEETING.

NUMERICALLY speaking, the Pittsburg meeting was not a great success. It is fortunate, however, that scientific activity and work does not depend upon numbers; and in this respect the session just closed compares more than favorably with those of past years. The papers presented were of a high order, showing careful work and real advance, and were listened to with interest. Prof. Rogers' address was a masterly production, and cannot but reflect great credit on the society as well as on its distinguished author. While not strictly microscopical, the subject considered by Prof. Rogers is so closely allied to this department of research, that it will be read by all thoughtful persons with the keenest pleasure. We regret that lack of space prevents our printing the entire address, but as the second part deals almost wholly with the discussion of a mathematical problem, we have decided to omit it. Many of the papers read before the society, the titles of which appear in the report, will appear in this journal previous to their publication in the society's transactions. This will give the members who were unable to be present in Pittsburg, an early opportunity to read them, and many others who are not connected with the society will be able to judge of the scientific work accomplished by it.

Perhaps the most important feature of these gatherings is the social element—worker meeting worker, becoming personally acquainted with one another, and by the discussion of moot-points, and the interchange of ideas, enlarging their experience and knowledge.

This feeling of good fellowship may be found in all the acts of the Society, and there is a noticeable absence of self-pushing and wire-pulling, which is so distasteful to all true lovers of science. The Iron City Microscopical Society deserves great credit, and certainly have the warmest thanks of all present, for their hospitality and generous efforts to make their visitors comfortable and enjoy the occasion. Taking all in all, the Pittsburg meeting may be considered, scientifically, as the most important gathering of microscopists yet held, and one of which the Association may well feel proud.

TECHNOLOGY.

TIN-FOIL CELLS.

C. M. Vorce, F. R. M. S., of Cleveland, says: Tin foil cells are extremely useful, and may be had of almost any desired thickness, up to that of sheet-lead. A cheap die for cutting cells can be made of three or four thicknesses of "telescoping tubing," which can be had from the tube-drawers. The tubes, when fitted, are to be cut into two lengths and "faced off" square and smooth, the outermost tube being left longer than the others. By putting a piece of foil on the squared ends of one set and opposing to it the squared ends of the other set, then forcing over all the outer tube a disk will be cut off, then by pushing through each alternate tube of the set, a series of rings will be cut out, leaving a solid central disk, very useful for making diatom-cells for arranged diatoms, by means of the punch previously described by me (in 1879) in the club letter-packets. The punch referred to consists of a brass rod with central hole fitted by a steel wire; the rod sawed in two, and turned into a disk and counter.—*Note Book Am. Postal Micro. Club.*

ACID CHROMO-OSMIC.—Dr. Max Flesch recommends the following:

Osmic acid,	-	-	0.10
Chromic acid,	-	-	0.25
Water,	-	-	100.00

The object may remain in this solution from 24 to 36 hours. It is then washed in water, and placed in alcohol.—*Jr. de Micrographie.*

ABSTRACTS.

O. SCHULTZE'S METHOD OF PREPARING THE AMPHIBIAN EGG.

For hardening-fluids the following mixtures were found to give perfectly satisfactory preparations when used in the manner described below:

1. *Chrom-osmio-acetic Acid.*

Chromic acid (1 per cent.)	25	parts.
Osmic " (1 ")	10	"
Water	16	"
Acetic acid (2 per cent.)	5	"

2. *Chrom-acetic Acid.*

Chromic acid (1 per cent.).....	25 parts.
Acetic " (1 ").....	5 "
Water.....	70 "

The eggs are left in one of these fluids twenty-four hours, then washed in distilled-water, which should be often changed. The egg-envelopes are next removed by the aid of needles, and the eggs are ready for surface study.

For the purpose of sectioning, the eggs are transferred from the water used in washing to 50 per cent. alcohol, then to 70 per cent., 85 per cent., and 95 per cent., leaving them twenty-four hours in each grade. The last grade should be changed several times. The eggs are then clarified in turpentine one to two hours, and then placed in paraffin that melts at 50°C. for one-half to one hour.

Schultze states that the success of the method depends on following precisely the directions given as to time. If the eggs remain longer, either in alcohol, turpentine, or paraffin, the results may be entirely unsatisfactory. If the conditions are strictly followed the eggs have the consistency of the paraffin, and cut excellently, without crumbling, in sections $\frac{1}{20}$ mm. thick.

For staining, borax-carmin was used, directly after washing, twenty-four hours. The eggs were next placed in acid alcohol of seventy per cent. (five drops of the pure acid to 100 ccm. of the alcohol,) to remove a part of the color.

The first hardening-fluid does not penetrate well, and is not well adapted for fixing the central part of the egg.—*American Naturalist*, June, 1887.

RESULTS OF MICROSCOPIC EXAMINATION OF DOUBTFUL MINERALS.—

Several doubtful minerals have recently been examined microscopically by Dr. Lacroix, (*Neues, Jahrb. f. Min., etc.*, 1887-1-p. 95). *Pterolite*, which Dana supposed to be an altered lepidomelane, Lacroix found to be a mixture of several distinct minerals, of which the most important are a black mica and a strongly pleochroic pyroxene. In addition to these there are also present in pterolite numerous grains of blue sodalite, rhomboheda of calcite or dolomite, and many other minerals which are usually found in eleolite syenites. *Villarosite* is shown to be merely a pseudomorph of chrysotile after olivine. *Gamsigradite* has the optical properties of hornblende, with a maximum extinction of 30 degrees and pleochroism in green and brown tints.—*Am. Naturalist*.

THE BACILLUS AND PTOMAINES OF LOCK-JAW.—Not long ago Nicolaier, working in Flugge's laboratory, found a bacillus which had the power to produce in animals the phenomenon of lock-jaw (*tetanus traumaticus*). Afterwards Rosenbach succeeded in obtaining the same bacillus from the wound of a man who had died of lock-jaw. L. Brieger has recently prepared from flesh a ptomaine which produces in animals the same symptoms as those which are produced by injecting the specific tetanus bacillus. To the substance he gives the name "tetanine." He has, further, found the same substance in a human cadaver which had for several months been undergoing spontaneous decomposition. Tetanine is a definite chemical compound which can be purified by the usual chemical methods, and was so purified by the discoverer. Brieger also found in tetanus-cultures another ptomaine which has the power to produce cramps and other symptoms closely resembling those of lock-jaw. The finding of the tetanus bacillus and ptomaine suggests an explanation of certain facts which have been known for some time. In some localities persons with wounds are particularly liable to lock-jaw. In one such locality, at least, large areas of land are covered for part of the year with the refuse from fish-oil factories. It seems not improbable that in the decomposition of the fish the ptomaine described by Brieger may be formed, and that, as the matter dries, it may find its way into the air to some extent; or it may be present in the earth, and contact with the earth may cause its introduction into the wound.

NEWS AND NOTES.

A LENS which magnifies, and yet is perfectly flat on both sides is a scientific novelty. It is made at Jena, by the manufacturer of Prof. Abbe's new optical glass. The lens consists of a single disk, whose density varies so that its refractive power decreases regularly from the surface inward.—*Scientific American*.

BACILLUS is the diminutive of *baculum*, and means a little rod. It is larger than bacterium, though both are characterized by a rod-like shape. Formerly the bacilli were confused in the general term *infusoria*. They were first specifically described by Müller before 1850.—*Nat. Druggist*.

THE Harvard Natural History Society, having for a number of years been in a particularly dormant state, has recently, by the energetic work of its president, Mr. Nolan, sprung into life again.

Under its auspices there will be a series of weekly lectures, or rather talks, at the Society's rooms, upon the local fauna and flora. These lectures will be delivered by Mr. Samuel Garman, upon the reptiles of Massachusetts; Mr. O. H. Scudder, on butterflies; Dr. J. S. Kingsley, on crustacea; Mr. James Emerton, on spiders; Mr. William Brewster, on birds, and others not yet announced.—*Science*.

AFTER a heavy shower in Washington recently, the gutters and low places were covered with a deposit of fine, yellow powder, Prof. Ward pronounced it vegetable pollen, which came from the pine trees of the district. It was very light, and was carried into the upper regions and washed out by the rain. Prof. Ward said: "It is the male element of the pine trees, which usually shed their pollen at this season. It consists of minute grains, like spores, and to the naked eye looks like yellow dust, but, subjected to the microscope, the grains have different shapes, which differ with the varieties of pine. It is common wherever pine trees exist."—*Science*.

BACTERIA IN SEA AIR.—Moureaux and Miquel have made microscopic analyses of sea air at various places, and state, as the result of their observations, that when the breezes come from the sea the air is almost free from bacteria. When one hundred kilometres out at sea the breezes coming from shore are also almost free from them, thus proving that the sea is an insurmountable barrier to contagion. On vessels making long passages it was noticed that although the compartments were not entirely free from bacteria, they contained about one hundred times less than in a Parisian home.—*Med. and Surg. Reporter*.

I hope that the microscope may not be relegated to the younger members of our profession alone. It is an instrument for old age. Ehrenberg worked with his microscope up to within a few days of his death. The focussing accommodates the defects of vision. Moreover, it is a comfort and solace to an aged physician to quietly explore the mysteries of the unseen world he has been dealing with microscopically during a long and laborious life. May it be a good preparation for that endless life where we shall no longer see through a glass darkly.—*Dr. E. Cutter*.

HUGO DE VRIES suggests, in *Nature*, a method of preserving such colorless plants as *Monotropa* in alcohol without their assuming a brown color. "To 100 parts of common, strong alcohol add two parts of the ordinary concentrated solution of hydrochloric acid of the shops."—*Botanic Gazette*.

BOOK REVIEWS.

THE MICROSCOPIST, A COMPENDIUM OF MICROSCOPIC SCIENCE, by J. H. Wyth, A. M., M. D., Professor of Microscopy and Histology in the Medical College of the Pacific, San Francisco. Fourth enlarged edition, pp. 434. P. Blakiston, Son & Co., Phila.; D. O. Haynes & Co., Detroit, Mich.

This book was first issued in 1851 as a manual on the use of the microscope for physicians and naturalists. Since that time it has passed through several editions and its field has been extended to cover pretty much everything appertaining to microscopical science. The volume before us contains full directions for the use of the microscope, mounting and preserving microscopic objects. It treats also, in a general way, of the microscope in chemistry, biology, histology, botany, geology, pathology, etc. It is profusely and admirably illustrated and is filled with much information valuable alike to the amateur and professional.

The fault of the work is that too much has been attempted, some of the subjects possessing an almost dangerous meagerness. Yet, if rightly used, we know of few books which could serve so useful a purpose in the hands of the all-round microscopist.

FRESH WATER ALGÆ OF THE UNITED STATES, (EXCLUSIVE OF THE DIATOMACEÆ), by the Rev. Francis Wolle, Member of the American Society of Microscopists. Two Vols. Price, \$10.00. Bethlehem, Pa.

It requires no knowledge of the art of prophecy to say that this work is destined to fill a position of authority on the subject of which it treats; for it is the only work which pretends to a complete record of these little plants so far as they have been found in the United States; and the author's scholarship is such as to preclude the possibility of the occurrence of technical errors. The writer's treatise on *Dermids* is well known; the present volumes were designed as complementary to it.

The work consists of two parts, the first containing the text—almost purely descriptive. The second—a large volume—the plates. To the study of these plates, one, even though not skilled in the subject, can devote much time, for they are carefully and artistically executed. Many of the plates (157) are colored, and altogether they furnish some 2,300 illustrations. The colors have the delicacy of water-colors, and a softness of outline suggestive of hand-work.

Considering the merits and extent of the work, the price is altogether too low, and we hope that the author's unselfishness will be liberally rewarded through an extensive circulation among botanists, to whom we heartily recommend it.

BULLETIN OF THE CALIFORNIA ACADEMY OF SCIENCES, Vol. II, No. 6, 1887.

We have received the above through the courtesy of Dr. Henry Ferrer, corresponding secretary of the Academy. The articles contained are of high order. Among those of more general interest we notice "Studies in the Botany of California and Parts Adjacent," V. Edward Lee Greene; "Descriptive Notices of North American Coleoptera," I. Thos. L. Casey; "Additions to the Ornithology of Guadalupe Island," Walter E. Bryant, and "Early Spanish Voyages of Discovery on the coast of California," Geo. Davidson, A. M., Ph. D.

THE MAVERICK NATIONAL BANK MANUAL, Boston, July, 1887, pp. 200.

"This volume of financial statistics, carefully compiled by specialists from the very latest sources," will be found useful as a work of reference, as it contains many facts on many subjects of finance, brought up to date. It is issued in good form.

THE TREATMENT OF HEMORRHOIDS, by Charles B. Kelsey, M. D. Geo. S. Davis, Detroit.

This small volume, the first number of the Physician's Leisure Library for 1887, comes out in a very neat and attractive form. The publisher has made a little innovation in printing it in brown ink. It is rather pleasing to the eye, but we are not sure that it is an improvement over black. The contents of the book are of a very practical nature. Dr. Kelsey's writings on this subject have been numerous, and although we are familiar, from the perusal of his books and journal articles, with his methods of treatment, the concise little hand-book before us forms a welcome essay of the subject.

We have received the advance sheets of a new work on Medical Jurisprudence, by the well-known medico-legal advocate, Dr. Marshall D. Ewell, F. R. M. S., of Chicago. The work will be issued from the house of Little, Brown & Co., Boston, and will be an invaluable addition to the physician's library. A further review of the work will appear later.

MICROSCOPICAL INVESTIGATION OF SUPPOSED SEMINAL SPOTS ON A CHILD'S CLOTHING, by R. Menger, M.D., San Antonio, Texas. *The Texas Courier-Record*, February, 1887.

THE RELATIONS OF PHYSICIANS TO THEIR MEDICAL SUPPLIES. A collection of editorial replies to the article with the above title in the January *Ephemeris*.

ENAMEL AND DENTINE. SOME THOUGHTS ON THE NEW THEORY CONCERNING THEIR STRUCTURE, by George S. Allen, D. D. S. Reprint.

CLINICAL REPORT OF SIX MONTHS' EXPERIENCE WITH THE PNEUMATIC CABINET, by C. W. McCuskey, A. M., M. D. Reprint.

ON THE USE OF THE MICROSCOPE IN DETERMINING THE SANITARY VALUE OF POTABLE WATER, by Geo. W. Rafter. Reprint.

PNEUMATIC DIFFERENTIATION AND THE PNEUMATIC DIFFERENTIAL PROCESS, by Herbert F. Williams, M. D. Reprint.

HOW TO STUDY THE BIOLOGY OF A WATER SUPPLY, by Geo. W. Rafter, M. Am. Soc. C. E. Reprint.

EIGHTH ANNUAL COMMENCEMENT OF THE INDIANA ECLECTIC MEDICAL COLLEGE, 1887-88.

THE STAINING OF ANIMAL AND VEGETABLE TISSUES, by Arthur J. Doherty. Reprint.

ANNOUNCEMENT OF P. BLAKISTON, SON & CO.'S NEW SERIES OF MANUALS.

MICROSCOPY. Reprints from *American Naturalist*, by Dr. C. S. Whitman.

CORRESPONDENCE AND QUERIES.

EAGLE BRIDGE, N. Y., JULY 25, 1887.

Editors of The Microscope.

Dear Sirs,—In your last number you say, that all who can afford it should by all means own a microtome. I have one which anyone can afford, for the microscopist with a little ingenuity, (and all microscopists are supposed to be ingenious), can make one for himself. The materials needed are a block of hard wood $5 \times 3\frac{3}{4} \times 2$, a fine thumbscrew with a nut on it, a piece of glass tubing and a glass slide cut lengthwise through the middle. Plane the top of the block perfectly true, then bore a hole, the centre of which should be $1\frac{1}{2}$ inches from the end, which the glass tube will exactly fit. Saw a strip from the bottom of the block and fit the nut in the hole. Cement the glass tube in the hole in the large block with marine glue, allowing it to project through nearly the thickness of the glass slide. Cement the glass slips on the top touching each side of the tube. Fit a block of wood $1\frac{1}{4}$ inches long, with a rivet in the bottom so that the thumb screw will work smoothly on it, to the glass tube. Screw the $\frac{3}{8}$ inch strip with the notch in it to the block and cut a notch $1\frac{1}{4} \times 2\frac{1}{2}$ in the block to fasten it to a table and the microtome is complete. Sections may be cut with a flat or common razor.

GEORGE GAY.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be given ONE INSERTION FREE OF CHARGE. Dealers are referred to our advertising department.

EXCHANGE.—I have well mounted slides of diatoms, also, diatomaceous material which I offer for curiosities or minerals suitable for a cabinet.

F. L. CAUCH, Carpenteria, Santa Barbara Co., Cal.

WANTED.—To purchase a Bausch & Lomb Universal Microscope with attachments. Give number of attachments, objectives and price.

DR. W. N. BAHRENBURG, 919 Wash. St., St. Louis, Mo.

LABELS for Slides; also, Slides and Material.

EUGENE PINCKNEY, Dixon, Ill.

FOR EXCHANGE.—Diatomaceous Earth from Los Angeles, for good mounts.

M. H. ALTER, M. D., 41 South Spring St., Los Angeles, Cal.

FOR SALE.—A Bausch & Lomb Universal Stand, a $\frac{1}{2}$ and 1.5 objectives, glass stage and slide-carrier, slide-cabinet, about 50 mounted slides, slides, cover glasses, stains, etc. A complete outfit, new, being used about three months. Good reasons for selling.

F. T. MERIWETHER, M. D., Asheville, N. C.

SALICINE-SLIDES FOR POLARISCOPE.—For exchange for thoroughly good histological or pathological mounts, or for sale, a few magnificent Slides of Salicine Crystals, prepared by a new process. The most gorgeous ever made. Also, some remarkable slides of urinary deposits, including tube-casts (hyaline, waxy and granular), epithelia of kidney, bladder, urethra, vagina, etc., blood, pus, etc., stained with eosin and osmic acid.

FRANK C. JAMES, Box 565, Saint Louis, Mo.

EXCHANGE.—Will exchange slides of vegetable sections, double-stained, for other good slides, preferably of the same nature.

CHAS. E. BARR, 301 Clinton St., Cleveland, O.

FOR SALE OR EXCHANGE.—A first-class Tolles dry, $\frac{1}{4}$ in. 100° in perfect condition. Price, \$25.

C. L. PETICOLAS, 635 Eighth St. N., Richmond, Va.

FOR SALE.—One copy Van Heurck's Synopsis Diatoms. Plates bound, best library, text unbound, in perfect order. Price \$40. Also 1-10 objective, Homo. im., 125° balsam angle, made by Herbert R. Spencer in 1883. Cost \$80, will sell for \$55. Perfect order, used very little. Address

H. F. DOUGLAS, Fenton, Mich.

FOR SALE.—A Bausch & Lomb Investigator Microscope complete, with improved glass stage and slide-carrier extra. Cost \$75 only a few months ago, has not been used a dozen times; is perfect in every particular. Will sell for 20 per cent. less than cost. Correspondence solicited.

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GOOD MOUNTS—Vegetal and various, for a simple section cutter.

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QUEEN'S COMFORTABLE TURN-TABLE in exchange for Rindfleisch's Pathology, or Dolley's Technology of Bacteria

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FOR SALE.—A Zentmayer 8-10 and 1.5 objectives; also, a B. and C. eye-piece, in good condition. The maker should be guarantee of quality.

J. G. DENGLE, Sellersville, Pa.

FOR SALE.—A perfectly new Bausch & Lomb Universal Microscope; has never been used. This includes two eye-pieces, one with micrometer; a 3-4 inch and a 1.5 inch objective; a camera lucida, a test-slide, pliers, slides and covers. Purchaser receiving in addition a copy of Carpenter's "Microscope and its Revelations," Stokes' "Microscopy for Beginners" (new), Davis on Mounting, and Bausch's manipulations of the Microscope. All in neat box with lock and key. Price \$50.

A. H. STIEBELING, M. D., No. 138 Second St., New York City.

FOR SALE.—A very good microscope; monocular, with case, eye-pieces and objectives, all being as good as new. Will sell at a good bargain; full particulars given. Address (Correspondence solicited.)

CHARLES VAN EIFF, 347 Greenwich St., New York City.

WANTED.—Standard books on Rotifera, Infusoria, Diatoms, Algæ, etc. Will exchange general scientific and literary works for the above.

JAMES E. WHITNEY, Rochester, N. Y.

FOR EXCHANGE OR SALE.—Double-stained Bacillus Tuberculosis slides. Will exchange for histological or pathological mounts.

F. T. MERIWETHER, M. D., Asheville, North Carolina.

FOR EXCHANGE.—I have for exchange for mounted slides, specimens of crystallized quartz, microscopic and small, perfect crystals, crystals from one-half to three inches in diameter, crystals containing floating particles, crystals containing cavities, and some containing hornblende. State which you prefer and I will endeavor to give satisfaction.

D. M. FULLER, 154 Hamilton St., Albany, N. Y.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,

At 32, 34 and 36 Seitz Block, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 25 Washington Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. Box 583, Detroit, Mich.

No receipt will be sent for subscriptions received unless specially requested.

Specimens for examination should be sent to the *Microscope Laboratory*, 25 Washington Avenue, Detroit, Mich. In all cases the transportation charges on these specimens must be prepaid, and special directions for packing and shipping will gladly be sent upon application.

VOL. VII.

DETROIT, OCTOBER, 1887.

No. 10

ORIGINAL COMMUNICATIONS.

I. MICROSCOPICAL TUBE-LENGTH, ITS LENGTH IN MILLIMETERS, AND THE PARTS INCLUDED IN IT BY THE VARIOUS OPTICIANS OF THE WORLD.

II. THE THICKNESS OF COVER-GLASS FOR WHICH UNADJUSTABLE OBJECTIVES ARE CORRECTED.*

S. H. GAGE.

IN the construction of microscopic objectives, the corrections must be made for the formation of the image at a definite distance, or, in other words, the tube of the stand of the microscope on which the objective is to be used, must have a definite length. Consequently, the microscopist must know and use this distance or "microscopical tube-length" to obtain the best results in using the objective in practical work.

In order to ascertain the exact distance in millimeters for which objectives are corrected, and the parts of the microscope included in this distance or "tube-length," the following questions were submitted to all the opticians of the world whose address could be obtained: 1. For what "tube-length" do you correct your microscopic objectives? Please give the length in millimeters or inches. 2. Please indicate on the diagram on the opposite page (fig. 1 of this paper) exactly what parts of the microscope you include in

* Transactions American Society of Microscopists, 1887.

"tube-length." From nearly all, precise and satisfactory answers were received, and I wish to express here my appreciation of their courtesy. The answers received are given below, and indicated on the accompanying diagram:

Table giving length in millimeters, and showing parts included in "tube-length" by various opticians.

Pts included in "Tube- lengths." See Diagram.	"Tube-length" in Millimeters.
a-d.	Grunow, New York.....203 mm. Nachet et Fils, Paris.....146 or 200 mm. Powell and Leland, London.....254 mm. C. Reichert, Vienna.....160 to 180 mm. W. Wales, New York.....254 mm.
	Bausch & Lomb Opt. Co., Rochester, 216 mm. Bézu, Hausser et Cie., Paris *.....220 mm. Klönne und Müller, Berlin.....160-180 or 254 mm. W. & H. Siebert, Wetzlar.....190 mm. Swift & Son, London.....228½ mm. C. Zeiss, Jena.....160 or 250 mm.
	a-g.....Gundlach Optical Co., Rochester....254 mm.
	c-d.....Ross & Co., London.....254 mm.
	c-e.....R. & J. Beck, London.....254 mm.
c-g.....H. R. Spencer & Co., Geneva, N. Y., 254 mm.	c-f.....J. Green, Brooklyn †.....254 mm.
c'-e.....E. Leitz, Wetzlar.....125-180 mm.	Oil immersions.....160 mm.

Fig. 1. Diagram showing the parts of the microscope included in "tube-length" by the various opticians of the world. (See table above.)

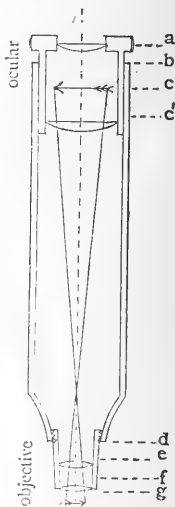
A glance at the table and diagram is sufficient to show that there is about as great diversity as possible in the parts included in "tube-length," and that the length in millimeters, including these parts, is likewise very diverse. This has, doubtless, come about simply because there was no general standard, and each optician selected for himself a standard. For the sake of those who use the microscope, it is hoped that a uniform standard may be chosen, or that, at most, but two standards should be decided on by all opticians. These two lengths in millimeters would probably best be 254 mm.

* Successors to Hartnack.

† Successor to Tolles.

for the long or English "tube-length," and 160 mm. for the short or Continental "tube-length." Furthermore, the same parts of the microscope should be included in the tube-length, and the parts included should be readily determinable by the youngest student. The parts included by six of the opticians named above, viz: from the top of the *d* tube (*b*) where the ocular is inserted, to the lower end (*d*) where the objective is screwed in, answers this requirement of simplicity. Without urging this as the best possible selection, it will readily be seen that this "tube-length" may be easily measured where the ocular and objective are not in position, and that makers of stands who do not also make objectives could easily make the tubes of their microscopes of exactly the right length for the objectives of all objective makers. While it is true that the objectives of various makers are in mountings of different lengths, and, therefore, other things being equal, tend to increase or diminish the actual or "optical tube-length," and thus to vary the magnification of the microscope, if each maker would choose the length designated above (*b-d*) for which to correct his objectives in their mountings, then no matter how long or short that mounting might be, the microscopist would be able to measure off the right length on the tube of his microscope, for which the objective was corrected, and having this length once determined, it would not need to be changed when an objective of different length of setting was used.

Furthermore, the convenience of the microscopist and uniformity in "tube-length" would be both subserved if the eye-pieces or oculars were made "*par-focal*,"* "that is the settings be so adjusted that the lower focal points of all the eye-pieces shall be at the same level when in position in the tube of the microscope,"† then no refocusing of the microscope would be necessary upon changing oculars. If also the level of the "lower focal points" of the different oculars were made to fall at the level of the top of the body tube of the microscope, one end of the so-called "optical tube-length" would be always determinable, and correspond with one end, that is the upper end, of the tube of the microscope.



* This convenient name was proposed by the editor of the *Microscopical Bulletin* in vol. iii., (1886), p. 31. See also p. 9, same vol.

† See page 8 of the catalogue sent out by Zeiss, with his apochromatic objectives and compensation oculars. Also, *Jour. Roy. Micr. Soc.*, 1886, p. 853.

So long as no common standard is employed, it seems to the writer that every objective should be accompanied by a statement and a diagram indicating the tube-length in millimeters for which it was corrected, and showing also the parts of the microscope included in this measurement. If the objective is unadjustable, a statement should also accompany it, giving the thickness of cover-glass for which it was adjusted. (See below under II).

II. The thickness of cover-glass for which unadjustable objectives are corrected.

As the thickness of the cover-glass as well as the "tube-length" has an important influence on the perfection of the microscopic image, and as almost all objects for microscopic examination are covered, the objective must be adjustable to compensate for the various thicknesses of cover-glasses used, or some uniform thickness of cover-glass must be selected, for which the optician corrects or adjusts the objective once for all. The thickness for which such unadjustable objectives are adjusted varies with the different opticians, as shown in the table below. The information in the table was obtained by direct inquiry as for the information concerning "tube-length."

Table showing the thickness of cover-glass for which unadjustable objectives are corrected by various opticians:

$\frac{2.5}{100}$ mm.	{	J. Green, Brooklyn.
		J. Grunow, New York.
		Powell and Lealand, London.
		H. R. Spencer & Co., Geneva, N. Y.
		W. Wales, New York.
$\frac{1.8}{100}$ mm.		Klönne und Müller, Berlin.
$\frac{1.7}{100}$ mm.		E. Leitz, Wetzlar.
$\frac{1.6-2.0}{100}$ mm.		Ross & Co., London.
$\frac{1.6}{100}$ mm.		Bausch & Lomb Optical Co., Rochester.
$\frac{1.5-2.0}{100}$ mm.		($\frac{1.6}{100}$ mm. apochromatic oil immersions), C. Zeiss, Jena.
$\frac{1.5-1.8}{100}$ mm.		C. Reichert, Vienna.
$\frac{1.5}{100}$ mm.	{	Gundlach Optical Co., Rochester.
		W. & H. Siebert, Wetzlar.
		R. & J. Beck, London.
$\frac{1.2-1.7}{100}$ mm.		J. Zentmayer, Philadelphia.
$\frac{1.0-1.2\frac{1}{2}}{100}$ mm.	{	Nachet et Fils, Paris.
		Bezu, Hausser et Cie, Paris.
$\frac{1.0}{100}$ mm.		Swift & Son, London.

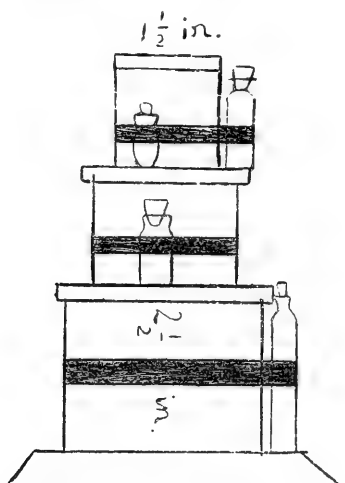
A uniform thickness of cover-glass for unadjustable objectives seems also desirable; then by the use of some cover-glass measure, like the one made by Zeiss, the microscopist could select covers of the proper thickness to be used for the specimens to be studied with unadjustable objectives.

CORNELL UNIVERSITY.

A NEW MATERIAL CABINET.

A. L. HOLDEN, M. D.

A VERY artistic and inexpensive material cabinet can easily be constructed in the following manner. It consists of three tin or wooden boxes, of equal height, with flat covers, varying in diameter from $1\frac{1}{2}$ inches to $3\frac{3}{4}$ inches. Take the largest, and fasten to the bottom a circle of wood or metal, $4\frac{1}{2}$ inches in diameter and $\frac{1}{2}$ inch in thickness. The projection will form a rest for the vials, which are held in position by a rubber band placed around each box. The next smaller box, $2\frac{3}{4}$ inches in diameter, should be fastened to the cover of the largest, and so on. The interior of the boxes form a receptacle for packets of dry material.



If painted a light color, the objects in the vials will be easily seen, and, when finished, it makes a useful ornament for the microscopists' table.

UTICA, N. Y.

HINTS ON THE FRESHWATER SPONGES.

BY HENRY MILLS.

AS the time is near at hand when the freshwater sponges may be found in places where they grow sufficiently mature for classification, a few hints on their appearance and on collecting and mounting them may be acceptable to many readers of THE MICROSCOPE.

It should be understood that what we find for sale in shops as sponge is merely the fibrous skeleton of a few species of marine sponge, which have been changed from their natural appearance by processes of cleansing and bleaching. These sponges have no spicula, but are tough and of a silky softness after being used a little. The freshwater sponge, on the contrary, is entirely destitute of fiber, the skeleton consisting of a framework of siliceous spicula, that is, little double-pointed needles of silex. These are held together and in position by the sarcode or fleshy mass of the sponge. This fleshy mass is a dense, somewhat jelly-like substance, which, on being dried, frequently shrinks away leaving to the unassisted eye little to be seen but the skeleton that supported it while living. In this condition the specimen might be mistaken for the ordinary commercial sponge, but, unlike it, may be reduced to an almost impalpable powder by rubbing between the thumb and finger.

The vital organs of the sponge consist of flagellate animalculæ placed in large numbers around little chambers called ampullaceous sacs. These animalculæ, by the united and continuous action of their flagella, produce a stream of water through the chamber. Several of these small streams unite in a larger one and these again unite to pass the water and effete matter out of the sponge through the largest openings, each of which is called a cloaca. The water for the supply of these small streams enters through innumerable pores at the base of the sponge, which suggest the name *porifera* for the whole family of sponges. The motion of the water, in both its ingress and egress may be seen in young and healthy specimens held in a watch-glass under the microscope, or even with a good pocket lens when the specimen is held in a thin glass tumbler. Small specimens may be preserved for weeks in a jar or tumbler containing some aquatic plants, such as the *Lemna* or *Utricularia*. One interesting feature in these young and growing sponges will well reward the student even if observed after some failures and disappointment in watching for it. It is the formation of a more or less elongated transparent tube or "chimney" on the surface of the sponge. It

appears at first to be merely a swelling or bulging out of the dermal covering. If this is watched attentively for an hour or two, it will be found to develop into a finger-like process with an opening at the end, through which the water and small particles contained in it pass out freely. A little bluing or carmine dropped into the water at this time will make the phenomenon much more interesting. At the same time the pores at the base of the sponge may be seen plainly to imbibe the water though in a much less demonstrative way.

Very young specimens of sponge may be found in June, July and August, but those of larger and mature growth are most abundant in September, October and November. Sponges are readily detected after a little initiation into the art of collecting, by their whitish-brown or pea-green color and bristly surface. They vary in size from half that of a pea to that of the fist. The shape is also variable, being globular, oval or flat and often conforming very much to that of the objects on which or between which they grow. They seem to prefer darkness, though they are frequently found exposed to considerable light. They may be looked for in the margins of rivers, lakes and ponds, and sometimes in deep water. In the last case any convenient drag for reaching the bottom may be used to secure them. I have found them most abundant in slowly-running or still water. The under sides of stones, pieces of wood, and submerged logs or boards often yield a rich supply. The rafts of logs that have been lying a year or two at a mill-dam are sometimes covered with them on the under sides, and I have found it a good plan to make friends with the men who run the logs into the mill, and who, for a small consideration, can be induced to take the sponges from the logs with a knife and place them evenly on a smooth board to be put away for a day or two until called for. Good specimens are sometimes found attached to water-plants in not very shallow water, *Anacharis*, *Utricularia* and *Myriophyllum* being their favorites. In some localities the long ribbon-like leaves of the *Valisneria spiralis* are covered with them. Hundreds of acres of this plant bearing sponges by the pound may be seen in the St. John's River, Florida. The finest specimen of *Carterius tubisperma* was found on the ground in the Niagara river, where it was partly obscured by weeds.

Sponges when removed from the places of their growth should be preserved by drying or in alcohol. Every specimen should be labelled as to date and locality. In the search for sponge, as well as most microscopic objects, it is necessary to be provided with a good pocket-lens, and to keep it constantly in use when doubtful or

unfamiliar objects occur. I am aware of two species found in this way, that must certainly have remained undiscovered if the pocket-lens had not been used. Most of the freshwater sponges, however, must be taken home and permanently mounted before the finer parts of the spicula or statoblasts, by which species are determined, can be defined. The statoblasts are the small, seed-like bodies distributed through the mass of the sponge. They are considered to be winter-eggs or resting-spores. Specimens may be mounted either before or after drying, the process being the same in both cases. A piece of the sponge, usually the smaller the better, is placed on a slide and subjected to the action of some clearing agent by which it can be made transparent. For this purpose some who are skilled in mounting sponges use a drop of strong nitric acid, which is placed on the specimen and afterwards heated over a lamp. The acid is then washed out with pure water and if the object is sufficiently clear it is dried and mounted in balsam. If it is not transparent the process of heating in acid and washing out must be repeated till the desired result is obtained. In my hands, however, the purest crystallized carbolic acid, rendered fluid by a little heat, will produce as good or better results with much less risk to the specimen. It will take but a short time after the application of a drop of the acid to the specimen before some parts of it, including, probably, some of the statoblasts will be clear enough for examination. When sufficiently transparent it may be mounted in balsam without washing, as the carbolic acid and balsam mix freely. Thin sections of dried sponges may be made by free-hand cutting or in the microtome by imbedding in any suitable material. These cuttings if carefully placed on the slide will show the statoblasts in section and the spicula *in situ*, frequently with no other medium than thin balsam. Should this be insufficient, however, a drop of the carbolic acid may be applied. Sections of the statoblasts are beautiful and instructive objects, affording knowledge of their various parts as well as of the arrangement of the spicula better than any other form of mounting. They may be cut through on the slide with a thin knife when that is most convenient, as is often the case.

The fleshy mass of the sponge may be destroyed by boiling the specimen in nitric acid or by soaking it for a time in Labarraque's solution of chlorinated soda. The spicula thus freed may be mounted in balsam in the same manner as diatoms. The spicula to be noticed first are those of the skeleton, which are the largest. These usually protrude through the dermal covering and give the slightly bristly

appearance to the sponge. They may be straight or slightly curved, smooth or spined, sharply or abruptly pointed. Second, the dermal spicula;—these occur in the outer covering of the sponge, though when mounted they are frequently dispersed through the whole specimen. They are very much smaller than the skeleton-spicula and are generally curved and spined, and may be sharp-pointed or blunt-pointed. In more than one species the dermal spicula are small birotulates. The third kind are the birotulates or two-wheeled spicula of the statoblast, which are placed radially in its outer wall. When there is only one kind of these the specimen is of the genus *Meyenia*, so named from Meyen, who in 1839 first discovered these bodies and their position in the statoblast. When there are two kinds of birotulates in the wall of the statoblast one longer than the other the specimen belongs to the genus *Heteromeyenienia* of Potts. If the spicula lie horizontally or tangentially on or in the wall of the statoblast the specimen belongs to the genus *Spongilla* of Carter.

To enumerate all the spicula that occur in all the species would extend this article beyond the proposed limits. The writer would be glad to correspond with any who may find specimens.

BUFFALO, N. Y.

A THOROUGHLY RELIABLE CEMENT.

M. A. BOOTH.

A TERSE, well-put sentence, appealing to a common experience, often times has more weight than a page of labored logic. And that member of the Postal Club who has so amusingly epitomized white zinc as

“Glossy and white,
Cracked and broken,
Endorsed by old fogies,”

has dealt a telling blow to that cement. While I do not recant and deny my just faith as to the efficacy of properly-prepared and properly-used white zinc, I submit that improperly-prepared white zinc, in hasty, careless, or inexperienced hands, will prove treacherous, and an exasperating failure. “Give us a good all-round cement,” says a Postal Club commentator. “Anything under the shining sun,” adds another.

After an extended and critical experience, I can say that I think that the cement prepared by Rev. J. D. King possesses all the desir-

able qualities of a universally-useful cement. To lovers of the beautiful, King's scarlet or blue cement is pleasing to the eye, while that large class of microscopists to whom such beauty is a blemish, will find in his amber cement, reliability shorn of any objectionable features. In every instance which I have known where King's cements have not proved fully satisfactory, the fault has been with the user. In using Mr. King's cements four points are to be observed:

(1) Keep your cement of the right consistency, if too thick thin it with alcohol.

(2) Use a Winsor & Newton Rigger brush No. 2; have its handle put through rubber cork and so keep the brush when not in use in a corked vial of alcohol.

(3) While using the brush wash it frequently in alcohol.

(4) Use no cement cells until they are *thoroughly dry*.

Observing these precautions we have an infallible cement.

LONGMEADOW, MASS.

PROCEEDINGS OF SOCIETIES.

THE SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE regular meeting of this society was held in the society's rooms August 10, 1887, President Wickson and a large number of members being present. In the absence of Secretary Breckenfeld, Dr. C. P. Bates, of Berkeley, acted as Secretary.

Among donations to the cabinet were four slides of tubercular bacilli from Dr. Riehl, of Alameda, stained with different preparations. William Norris presented a recently-issued part of Walker & Chase's series of "New and Rare Diatoms." Mr. Norris remarked the singular beauty of some of the newly-discovered diatoms. Those shown were from the Barbadoes deposits, a locality which has yielded fine finds of foramifera.

Prof. Henry G. Hanks read an interesting paper, illustrated by diagrams, concerning a diamond found in this State. The first diamond, he said, was found by Mr. Lyman, of New England, who saw in 1850, in the new gold mines, a crystal about the size of a small pea. It was slightly straw-colored and had convex faces. From that time to the present these gems have been occasionally found in our State, but never in large numbers, nor of unusual size. Professor

Hanks said it has long been his opinion that if hydraulic mining had been allowed to continue, a system of concentration would have been adopted which would result in a larger production of gold and platinum and in the finding of more diamonds. At the present time we know of the existence of diamonds in five counties in the State, as follows: Amador, Butte, El Dorado, Nevada and Trinity. It is not unlikely that they may yet be found in California more plentifully than before.

A very beautiful and remarkable diamond has lately come into the possession of J. Z. Davis, a member of the Microscopical Society, and this one Professor Hanks submitted for examination. It was found in 1882 at Volcano, Amador county, by A. Schmitz. It weighs 0.361 grammes, or 5.570 grains, equal to 1.571 carats. It is a modified octahedron, about three-tenths of an inch in diameter, very nearly if not quite colorless, perfectly transparent, but not without some trifling inclusions and faults. The form of the crystal is unusual. Professor Hanks has found such a one described or figured in books. The general form as shown by examination is that of a regular octahedron, but the faces seem convex. The whole crystal assumes a somewhat spherical form and the edges of the pyramids are channels instead of planes, but on closer examination it will be seen that the channeled edges, the convex faces and the solid angles are caused by an apparently secondary building up of the faces of a perfect octahedron, and for the same reason the girdle is not a perfect square, but has a somewhat circular form. These observations were well shown by drawings exhibiting in enlarged form the outlines of the gem. The faces seem to be composed of thin plates overlying each other, and each slightly smaller than the last. These plates are triangular, but the lines forming the triangles are curved, and the edges of the plates themselves are beveled. Mr. Hanks remarked further that it could be seen by the enlarged crystal shown under the microscope, and by drawings exhibited, that each triangular plate was composed of three smaller triangles, and that all the lines were slightly curved. The building up of plate upon plate causes the channeled edges and the somewhat globular form of this exquisite crystal. The sketches shown were made from the diamond, while in the field of the microscope, by the aid of the camera lucida, being enlarged about ten diameters.

A close examination of the crystal revealed tetrahedral impressions as if the corners of minute cubes had been imprinted on the surface of the crystal while in a plastic state. These are the result

of the laws of crystallography, as were seen by the faint lines forming a lace work of tiny triangles on the faces when the stone is placed in a proper light. Professor Hanks concluded with the remark that it would be an act of vandalism to cut the beautiful crystal, which is a gem in two senses, and he protested against it ever being defiled by contact with the lapidary's wheel.

The diamond was placed under the microscope and arranged by Professor Hanks to demonstrate the points of his very accurate description. It was a beautiful object and was admired by all present.

Dr. Riehl, of Alameda, gave a demonstration of discovering tubercule bacilli in the sputum of consumptives. He proceeded with the operation of staining, decolorizing, etc., and finally showed the minute germs clearly under the lens. Dr. Riehl made no claim to originality in the method employed, but showed how he handled the material so as to disclose the bacilli quickly for purposes of diagnosis. Discussion ensued as to the value of different methods, Dr. Ferrar and Dr. Mouser maintaining the value of the careful and exact methods of procedure laid down by the German investigators for purposes of exact determination. Dr. Mouser showed a very handsome piece of apparatus called "Schlessing's Thermo Regular," which he had just received from Germany. It is to be attached to the incubator used in cultures of bacilli, etc., in such a way that the water of the incubator comes in contact with the rubber plate of the regulator and expands it. This expansion of the rubber presses upon the other parts in contact with it and partly closes the pipe, admitting gas to the jets which heat the incubator. The appliance is so delicate that an elevation of one-tenth of a degree in the heat will act upon the gas flame and reduce it.

President Wickson exhibited a specimen of sonorous sand sent to Professor Hilgard by W. G. Thompson, of Pescadero, and referred to him for examination. Mr. Thompson's letter explained that the sand when driven over or walked on or even disturbed with a stick or the hand, gives out a distinct musical sound. Perhaps the strangest thing about it is that the persons longest in the vicinity of Pescadero seem not to know of the existence of such a place. It is away from the usual places of resort. The much-talked of "singing beach" of Manchester, Mass., is only one-fifth of a mile long, while Mr. Thompson has traced this sand at Pescadero along the beach for over a mile and a half. Mr. Wickson remarked that the subject of sonorous sand had been before the society some years ago in connection

with specimens sent from the Sandwich Islands, and had been studied by Prof. Hanks. The society's cabinet contains a slide of the Sandwich Island sand. The Pescadero material would be studied in the light of these facts, comparisons made, and the subject presented at a subsequent meeting. Specimens of the sand were distributed to those present.

J. Z. Davis showed a sample of kelp from the southern coast, covered with minute shells of mollusca, so that the green kelp seemed almost white. The subject was referred to Dr. H. W. Harkness, with the request that he report at a subsequent meeting.

The society then adjourned.

A. H. BRECKENFELD, *Rec. Secretary.*

ST. LOUIS CLUB OF MICROSCOPISTS.

THE members of this club met at the College of Pharmacy, Tuesday evening, September 6, and held one of the most interesting sessions in its history. A. J. Hoenny had just returned from the Pittsburg meeting of the American Society of Microscopists, and gave a full account of the proceedings. J. C. Falk had the head of a tape-worm mounted for inspection, and gave a short account of this little animal. Frank Davis exhibited powdered rhubarb which had been grossly adulterated with sand. Otto Meyer, A. C. Speth, Wm. Ilhardt and others contributed to the evening's work. D. L. Haigh and V. E. Schaller were elected to membership. The club sent a telegram of greeting to the American Pharmaceutical Association in session at Cincinnati. The next meeting will be held at the college, Tuesday evening, October 11, at which the members of the club will have their microscope and exhibit some of their own work. The students of the college are especially invited to attend this meeting, but all who are interested in microscopy are welcome.

THE TROY SCIENTIFIC ASSOCIATION.

THIS society held its annual "Field-Meeting" at Mt. Monadnock, N. H., on June 21 and 22, a party of forty traveling by special car from Troy. Notwithstanding occasional interruptions by passing showers and heavy clouds, twenty-four hours were spent upon the mountain with great pleasure, and interesting collections of plants, insects and minerals were made. The Monadnock trout ponds were also visited, and the artificial breeding of those dainty fish studied at leisure. At the Mountain House, during the

evening, Dr. R. H. Ward, President of the Society, gave an opening address upon the Vegetation of the Mountain. Mr. Wm. E. Hagan followed with remarks on Artificial Fish-Culture; J. W. A. Cluett, on the Minerals, and J. A. Lintner, of Albany, on the Insects collected, and F. P. Allen on Social Topics. This, the first meeting held by the Society in, or rather above, the clouds, its former visits to mountain regions never having failed of finding clear weather, was still one of the most interesting and successful of the series which the Society has kept up uninterruptedly for the past twenty years.

CENTRAL NEW YORK MICROSCOPICAL CLUB.

AT the annual meeting of the Central New York Microscopical Club held in Syracuse, the following officers were elected for the coming year: President, Rev. D. W. Smith; First Vice-President, R. Aberdein, M. D; Second Vice-President, Geo. K. Collins; Secretary and Treasurer, Will H. Olmstead; Directors, Alfred Mercer, M. D., R. Robotham, John H. G. Burns.

The next meeting of the Club will be held on the last Monday of September.

WILL H. OLNSTED, *Secretary*.

ELEMENTARY DEPARTMENT.

EIGHTH LESSON.

“CLEANLINESS IS AKIN TO GODLINESS.”

SEALING AND CEMENTS.—The sealing of the cover-glass is necessary when glycerin or any of its preparations are used as mounting media. The reasons for this were given in the last lesson. Though not necessary when gummy or balsamic media are employed, it is often applied to them for ornamental or finishing purposes by those whose tastes run that way. If the worker is not expert in the use of balsam, and gets too much or too little in the mount, the scraping away of the excess in the former case, or of the daub left at the filling point in the latter, will not, however carefully done, leave the most desirable results. In such cases, if the worker's æsthetic proclivities are strong, nothing is better, after a careful scraping and polishing with a drop of turpentine—taking care not to allow it to eat under the cover—than the application of a ring of the medium employed, be it gummy or balsamic. This the writer has found not only tasty but durable.

For glycerin and its preparations a large number of cements has been recommended. They are of all sorts and colors, and while the majority of them are good, we find, as in the case of mounting media, that three or four of the more tried ones will answer every purpose.

As for the use of colored cements, there should be but one opinion: with the exception of the more neutral tints, such as black, dark-brown, etc., their employment is dangerous to artistic success. To obtain a good result, the color of the cement should harmonize with that of the specimen. This the average microscopist seldom thinks of doing. When working with decided colors this harmony is exceedingly difficult to obtain. Do not assume that you have the creative faculty of an artist: you may be a good judge of the artistic, but that does not imply that you can make artistic things. NEVER use several colors in the same ring. If you *must* defy all artistic decency, at least confine yourself to the employment of a single color. For example, a heavy blue ring around a specimen stained a bright green should be sufficient to delight the most depraved. When a single color is thus used one has the power to assume that the exhibited depravity, though innate, has at least the merit of being unconscious. But with those elaborate combinations—combinations which exhibit an ingenuity worthy of better things—there can be but one conclusion: the outrage was deliberate. To do justice to such cases requires the pen of an aroused Ruskin.

Simplicity is not only the safest but truest. One of the safest colors for general use is black, and that color is now mostly employed by those whose work is considered to be among the best. Not only does it harmonize, by virtue of its neutrality, with the specimen color, but draws out and develops that color. For a very decided stain, such as a bright carmine, a brownish-black cement will serve to tone it down. And so with the employment of other colors—the effect can be heightened by careful combinations.

A perfect cement should be durable, firm, smooth, non-contractile, and insoluble in the mounting medium with which it is used. Though no one cement combines all these qualities in the highest degree, those here given will be found to do good service:

ZINC-WHITE.

Benzol.....	8 parts.
Gum dammar.....	8 parts.
Oxide of zinc.....	1 part.

Dissolve the dammar in the benzol and filter through absorbent cotton. See that the zinc is perfectly dry, then place a small portion in a mortar, and rub up with the dammar solution. When completed add more zinc, and continue thus till the whole is thoroughly incorporated. Care should be taken that the zinc is rubbed smooth, all lumps remaining after careful trituration being removed. This cement—and, for that matter, all cements—should be kept in closed bottles. When well made this zinc white will prove very serviceable, being hard, durable, and of smooth finish.

BRUNSWICK BLACK.

This is an asphalt varnish, known in commerce as “Brunswick black.” It can be used as obtained in the shops. A most satisfactory cement can be made by taking one ounce of the prepared asphalt mass (from which the varnish is made by dissolving in turpentine) and dissolving it in a solution of ten grains of caoutchouc in two ounces of benzol. A preparation something like the above the writer has used almost to the exclusion of all others. It makes an elegant appearance, and has shown itself very durable. Frey recommends a French enamel leather-dressing much used by Bourcogne, of Paris, whose mounts are highly esteemed. The writer has never used it.

GOLD-SIZE.

This can be obtained from any dealer in painters' goods. The color is not an especially happy one, but it makes a very hard, reliable cement. They who cannot obtain the ready-made article can make it as follows: “Grind together twenty-five parts of strained or filtered linseed oil, one part calcined red ochre, and one part red lead, and boil for three hours. Let stand until the solid matter sinks to the bottom, and decant the clear fluid. Mix the latter with an equal bulk of white lead, boil for an hour, and again let stand and decant.”—*James' Elementary Technology*

Besides the cements given above there are a number of others much used, but the writer has found that with Zinc-white, Brunswick black, and Canada balsam, all necessary work can be done. A very delicate sea-green color can be imparted to Canada balsam by adding to it a quantity of brass filings. The effect is a very pretty one, and was much used by the late Dr. A. Y. Moore, of Cleveland. Of course, such a preparation should be kept only as a cement, and never used as a mounting medium.

EDITORIAL.

UNIFORMITY OF TUBE-LENGTH.

EVERY microscopist will thank Professor Simon H. Gage for publicly calling attention, in his article, read at the recent meeting of the American Society of Microscopists, and published in this number of *THE MICROSCOPE*, to the remarkable lack of uniformity which exists among opticians in their standards of tube-length and in the parts which they include in their computation of it.

All who seek and desire accuracy in their objectives, understand that they are corrected for a definite tube-length, and that perfect performance is possible only when that tube-length is used. The lack of knowledge, even among expert microscopists, of the exact length for which given objectives are corrected, and the difficulty of measuring it from the hidden points adopted by many makers, have led them frequently to disregard the perfect accuracy which they should observe in adjusting their microscopes, and to be satisfied with an approximation to the proper tube-length. Text-books and makers' catalogues, also, are almost silent in the matter, and microscopists who use the microscope in their every-day business, but who give but little attention to the optical principles of its construction and working, have remained in ignorance of any necessity for such an adjustment. Professor Gage's article, with its complete tables, brings the subject forcibly to the mind of every microscopist, and makes clear the necessity of the adoption by makers of a uniform tube-length, and of uniform and easily accessible points between which to compute it.

Professor Gage, in his remarks, rather hesitated to ask opticians to change their various standards to a common one. From conversations with several opticians we have learned that there are no serious objections to such a change, and we urge upon manufacturers that it be made. The committee appointed by the A. S. M. to investigate the subject and report at the next meeting may, if their judgment agree with ours, accomplish much to this end.

A tube-length of 254 mm. is generally spoken of as the standard, and is adopted by the majority of opticians, and this, we believe, should be the only one chosen.

In determining the parts to be included in the measurement of tube-length there is more opportunity for diverse views. The most scientific measurement, probably, would be between the optical cen-

ter of the objective and the optical center of the ocular. These points are, however, the most difficult to determine, and they vary with each objective and each eye-piece. The same objections hold good with any measurement which has for its lower extremity any part of the objective. Uniformity in the length of the setting, and the position of the lenses of objectives, is practically impossible. The lower extremity of the tube ("d" in Prof. Gage's figure) is the only lower fixed point, and is the point selected by all but a very few opticians.

For the upper point "c" and "c'" can be excluded, "a" and "b" being the only points that are fixed and accessible, and the majority of opticians include the parts between one of these points and "d" in their measurement of tube-length. These points can be determined by the youngest student, and variations in objectives will not affect the length. Professor Gage prefers the measurement "b" to "d." This is, perhaps, the simplest, but is open to the objection that different opticians use eye-pieces of different construction. European makers use the Continental pattern, in which the eye-lens is but one or two mm. above the body, while Americans prefer the eye-piece with neck, which brings the eye-lens 12 to 15 mm. above the body. This, of course, increases the optical tube-length just so much, and it would be necessary for opticians to indicate on the objective whether it was corrected for the Continental or the American ocular. With the measurement "a" to "d" each microscopist could easily adapt his tube-length to suit either style of ocular.

We can join Professor Gage also in his plea for "par-focal" oculars. Their adoption would be another step in the development of a uniformity in apparatus, which is of so great convenience to busy workers, and which tends so much to harmonize the work of various manufacturers.

We believe that these subjects, so tersely brought forward by Professor Gage, should be agitated until manufacturers adopt them; and to further this end we shall be glad to publish correspondence from all interested opticians and microscopists.

We regret exceedingly to hear that the able Secretary of the San Francisco Microscopical Society, Mr. A. H. Brechenfeld, has tendered his resignation as an officer of that society. Mr. Brechenfeld will hereafter reside in San Diego, where we trust his enthusiasm and interest in microscopical matters will inspire others to the formation of a society and that much valuable work may be done in this line of research.

TECHNOLOGY.

PREPARING LACTARIUS TO SHOW BRANCHED LACTIFEROUS VESSELS.

D. A. Weiss finds [S. B. K. Akad. Wiss. Wien, xci. (1885)] that pieces of *Lactarius deliciosus* should not be kept too long in spirit, and the sulphuric acid shows the course of vessels very plainly, the contents of the tubes assuming quickly a blue-black color. The surrounding tissue being greatly affected by the reagent, the laticiferous vessels appear still more clearly, slight pressure on the cover-glass serves to separate them for some distance. Iodine-water imparts to the tubes and their contents a trace of green, which is rendered more intense by potash, and the juice appears in large dark-orange colored drops. The color afterwards passes into brown. Ferrocyanide of potash, sulphocyanide of potash and nitrate of silver, bleach the juice. Platinum-chloride, cobalt-oxide, chromic acid, and potassium-bichromate have no effect. Gold-chloride stains the vessels blue-black, the hyphæ, greenish-yellow. Sulphuric acid stains the contents of the vessels yellow, yellowish-green, greenish-black, and finally blue-black; the contents of the hyphal filaments rose-red. Iodine solution brings out a very dark, almost black, color in the vessels.—*Jr. R. M. Society.*

CEMENT FOR FINISHING SLIDES.—Mr. Thos. Lisle (*Journal Microscopy*) gives the following directions: Take dry white-lead (flake-white) and crush it fine with a spatula, or old table-knife, add as much turpentine as will make a thick paste, then grind fine. Something is then wanted to bind the color together when dry. Damar or Canada balsam will do, but neither is as good as copal varnish. Several kinds of this varnish can be had at the oil and color shops, but for this purpose it must dry without heat and be free from color. That which is known in the trade as lamp-head varnish is the best, it dries in about two hours; cabinet varnish is good, but rather longer in drying. Spirit varnishes are worthless for this purpose, as they are brittle. About an equal bulk of varnish should be added to the color; if less is used the work will look dull, if more is used the color will be wanting in body. Before proceeding to lay on the colored ring, it is a safe practice to put on two or three coats of something which will prevent running in. I have used two coats of copal varnish, each to be well dried before laying on

another. I have also used a varnish made of shellac dissolved in methylated spirit, and, as this is brittle, I add about one-eighth gutta percha. This is a useful cement for gelatin and glycerine mounts. The rings should have one or two coats of pure varnish as a finish.

DEMONSTRATION OF BILE-CAPILLARIES.—For the demonstration of the biliary capillaries, Dr. M. Muira used the following methods: (*Virchows Arch. F. Pathol-Anat.* xcix, 1885,) A small piece of liver, after having been in Müller's fluid for 25 days, is washed with ordinary water and laid in distilled-water for 35 hours. It is then transferred for 23 hours to a 15 per cent. watery grape-sugar solution. It is next placed for two or three days in a 0.1 to 0.2 per cent. solution of gold-chloride. The gold solution is to be changed two or three times. Finally the preparation is again left for two or three days in the grape-sugar solution, but without access of air, until it assumes a dark-violet or black color. The bile-capillaries are stained a purple red.—*Jr. R. M. Society.*

DIRECTIONS FOR USING PROF. H. L. SMITH'S HIGH REFRACTIVE MOUNTING MEDIA.*—Use barely enough of the medium to fill in under the cover when the slide is warmed; it does not materially diminish by any subsequent heating.

Boil thoroughly under the cover, and until all bubbles disappear on allowing the slide to cool; if any should still remain they may be readily coaxed out by proper application of a small flame.

When the slide is cold the cover should remain firmly fixed; any excess of the medium must be removed by means of a moist cloth or a roll of moistened tissue paper. The cleaning must be thorough; all excess must be removed around the edge of the cover, as otherwise it is liable to act upon the cement, or finishing ring. If, after the cleaning, the cover shows metallic stains, do not attempt to clean them off until after the finishing ring is hard.

When the excess has been removed around the edge of the cover, gently warm the slide to drive off the small amount of moisture that may have been absorbed during the cleaning. When again cooled apply a protecting ring of asphalt-black or white-zinc or—perhaps better if one will take the trouble to make them—a wax ring, punched from the sheet-wax used for artificial flowers. The wax ring is a sure protection, especially for the highest medium,

*Furnished by the Palmer Slide Co.

yet the white-zinc or the asphalt answers well. In using the wax ring, the heat must be very cautiously applied, so as barely to melt it, following gently around with a very small flame. If bubbles of air are entangled under the ring, touch them with a heated needle point just before the wax cools.

When the asphalt, white-zinc or wax ring is solid, apply a good coat of shellac dissolved in alcohol. Slides thus protected keep perfectly well. After the ring is firmly set, any metallic stains remaining on the cover may be removed by a bit of tissue paper moistened with hydrochloric acid. H. L. S.

STAINING THE BACILLUS OF GLANDERS.—The bacilli are best stained with a concentrated alkaline solution of methylene-blue. For staining the bacilli in sections of tissue containing them, Löffler recommends that they be immersed in the above-mentioned solution for 12 to 24 hours, and then carefully treated with very dilute acetic acid, until the sections have been decolorized sufficiently to bring the bacilli into view. After this treatment they should be washed out in alcohol, and immersed in oil of cedar, which does not dissolve out the aniline colors, and is therefore to be preferred to oil of cloves in all preparations in which these colors are used for staining bacteria.—*Sternberg in Med. News.*

ABSTRACTS.

MORPHOLOGY OF BEANS.

Dr. Ephriam Cutter in the *Albany Medical Annals*: Taking the bean botanically, it is the seed of the phaseolus species of the



FIG. 1.

leguminous family. The seed is made of the germ and two lobes, called cotyledons, which are seed-leaves loaded with starch to serve as food for the germ and for animals.

The seed is covered with a thick skin or envelope, which is made up of a set of beautiful prismatic crystal-like shapes of cellulose, placed side by side longitudinally, so that these ends make the outside and inside surfaces of the skin or envelope, and appear very much like the tops of the Giants' Causeway crystals of trap-rock.

(See Fig. 1.) The group to the right shows three or four rows of these cellulose bodies. They are displaced by the pressure of the cover and slide, and appear to be end to end. In the middle of each prism is an hour-glass contraction, which is in the central axis and is surrounded with clear cellulose, which fills out the contour. To the left, two groups of the face of the outer bean-membrane are seen, showing the prism ends in contact. The crystal-elements of the membrane are quite insoluble, polarize light, and resist the digestive influences of the alimentary canal. They are found in large quantities in the excrement of bean-eaters, and furnish a sure proof, when found, that beans or peas enter into the diet of the case under examination.

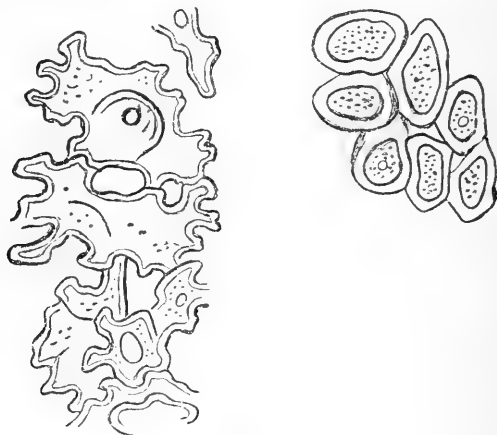


FIG. 2.

The epithelia of the Lima bean are seen in Fig. 2, left group. When interlocked, unsoftened and unseparated by cooking, they must hold together the parts, over which they are spread, with great firmness.

The substance of the bean is made up of starch grains, connective tissue, spiral vascular tissue, etc. The starch is not peculiar in its appearance and is readily recognized. In a section of an uncooked bean the starch grains appear in globular masses of vary-

ing sizes, filling up, apparently the meshes of connective fibrous tissue, which is quite thick, fibrous, homogeneous, polarizes light, and is probably cellulose or woolly fibre, very resistant to outside influences.

PHYSICAL PROPERTIES OF THE AXIS CYLINDER.—Mr. Franz Tangl, after investigating the histology of crushed peripheral nerves, (*Archiv. f. mikr. Anatomie*, 1887, page 464.) reaches some interesting conclusions regarding the axis cylinder. The preparations were made after Neumann's method of applying a temporary ligature to the *nervus isiadicus* of a guinea-pig. The portions were then removed and hardened in Müller's fluid and afterwards stained in a 1% aqueous solution of nigrosin, or an alcohol-aqueous solution of fuchsin. Tangl found such preparations far better for axis-cylinder studies than those prepared in the usual way with osmic acid, which blackens the medullary substance, thus obscuring the cylinder.

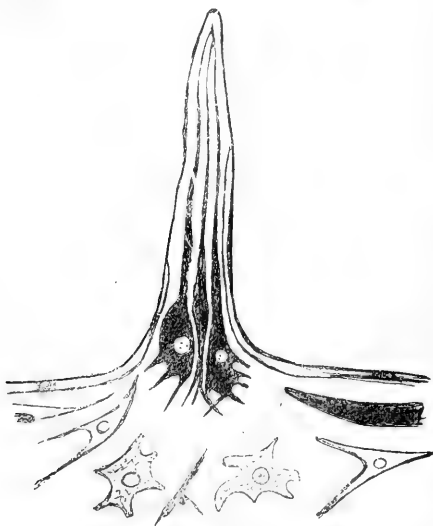
Studying these preparations he found, (1) that when the ligature had been tightly drawn, the axis cylinder was usually severed and that the two portions did not, as claimed by Neumann, mix with the surrounding substance, but drew away, curled up and remained as distinct bands. (2) That when the ligature had been more lightly applied the axis cylinder was not severed, but only compressed, though the sheath and medullary substance were broken. From this he concludes that the axis cylinder is a soft, firmly knit, (therefore *not* fluid,) and, perhaps, elastic, constituent of the nerve fibre. His studies are still in progress at the biological laboratory in Buda-Pest.

BLOOD OF *SMERINTHUS TILIE* PUPA.—At a meeting of the Entomological Society of London, on December 1st, Mr. Poulton exhibited the bright green blood of the pupa of *Smerinthus tilie*, which is one of many lepidopterous pupæ possessing a chlorophyll-like pigment (called metachlorophyll by Mr. Poulton) in the blood. By means of a micro-spectroscope the most characteristic absorption-band of the pigment, together with its resemblance to chlorophyll, was shown.—*Am. Naturalist*.

EYES OF PROTOZOA.—So-called eyes have often been described in the Protozoa. The latest instance is that of *Gymnodinium polyphe-mus*, described by Pouchet at a recent meeting of the French Academy. In this species of Flagellate there is described a strongly-

refrigent lense seated in a cup of black or red pigment. The lense arises from the fusion of several refractive globules, and the pigment layer or choroid from the similar coalescence of pigment-granules. The animal, in swimming, always moves the "eye" forwards.—*Am. Naturalist*.

SENSE-ORGANS OF SPONGES.—Von Lendenfeld describes, under the name synocils, some peculiar sense-organs in *Grantia*, which had previously been described by Stewart as palpocils. From the surface project long conical processes, about 0.1 mm. in length, most numerous near the incurrent pores. These organs consist of prolongations of the mesodermal intercellular substance, and are apparently covered with a delicate epithelium. At the base are several oval nuclei, each surrounded with an irregular envelope of protoplasm, which sends out root-like processes, one of which runs



to the tip of the synocil, (see cut). Von Lendenfeld suggests that the reason why these organs have escaped observation by all who have studied living sponges is that they are ordinarily retracted, and he recalls certain observations which he had previously made on the retracted sense-organs of other sponges. He hints at interesting comparisons of these with some of the peculiar sense-organs of the higher Metazoa, but without entering into any detail.—*Am. Naturalist*.

ROBERT KOCH—HIS WORK AND METHODS.—The entire second story of the Board of Health building, (Berlin), is devoted to the laboratory purposes, and, for convenience, has been divided into two large working rooms, besides several other smaller apartments for individual research. A single room, perhaps twelve feet square, with double walls, between which is kept flowing a constant stream of corrosive sublimate solution (1 to 1,000), is called the *Cholera-Zimmer*, and in it is placed the little jar of cholera dejecta, which is replenished from time to time from cholera infected localities. This room is closely watched, and, except at stated intervals, no one is allowed admission. Another room is fitted up with the apparatus adapted to bacteriological study, such as steam and hot-air sterilizers, and the various materials used in the preparation of the cultivating media. The laboratory is heated by steam, and an even temperature maintained day and night. The course which the writer was privileged to take began on the 15th of December, and closed on the evening of the 24th. The daily session lasted from six in the morning until dusk. On entering, we were assigned to private rooms, and each given a suit of stiffly-starched linen clothes, which we continued to wear during the working sessions of the entire course. Leaving all else behind, we proceeded to the so-called cooking room, where we found the various ingredients necessary for the preparation of the cultivating media already weighed out for us. These we combined and sterilized, according to a set of rules peculiar to Koch's system, and with which, I presume, most of my readers are now more or less conversant. It requires the better part of two days to make the nourishing substances; but these rather dry details over, the work is more interesting. On the morning of the third day, we made our first visit to the *Cholera-Zimmer*. In the centre of the room, on a plate of glass, stood the little tin box, about the size of a small pill-box, containing the cholera discharges from which we were to make the inoculations. The glass plate was covered with filter-paper and saturated with sublimate solution. After inoculating the tubes of food gelatin, they were poured out in the liquid state upon sterilized glass plates, to allow the different species to colonize. By this means, we were able to obtain a pure culture in about thirty-six hours. To impress the peculiar growth of this organism more strongly upon the mind, various other bacteria were cultivated at the same time, and the contrast between them made apparent by their manner of growth, rather than by their untrustworthy microscopic appearances. In recalling the pleasant hours spent in this labora-

tory, it would be a gross oversight not to mention the mid-day lunch to which we were treated. From the time of entering in the morning, until four or five in the afternoon, we were not allowed to leave the building. This, of course, necessitated some refreshment at mid-day, and, in the good old German style, it consisted of sandwiches and beer. The hours from ten to twelve each day were spent in the cholera room, and after passing through a thorough disinfection by means of external heat and cold, and a final washing in corrosive sublimate solution, we gathered about a long table, with Dr. Koch seated at the head. The conversation would naturally have to do with the morning's work, and, to the writer, the half-hours thus spent proved by far the most interesting part of the course, taken up as they were with personal experiences, intermingled with rare bits of information pertaining to bacteriological study. The lunch over, the afternoons were given up to an examination of the cultures in their various stages of development, and the preparation of permanent microscopic slides. The last three days were devoted to inoculation experiments upon rabbits, guinea-pigs and white mice. As to the results of these experiments, I may say that they were successful only when the culture was introduced directly into the duodenum. When fed to the animals in appreciable quantities, no trustworthy symptoms were induced, and at the autopsy it was invariably found that the microbes had perished during their passage through the stomach. This bears out Koch's theory of the fatal action of the gastric juices upon this organism. It also closely follows our knowledge of the disease, for some impairment of the digestive process has always seemed the most important factor in cholera infection.

In personal appearance, Dr. Koch is slightly above medium height, of rather stout habit, with dark complexion and prominent features. His eyes are deep set, the result, no doubt, of prolonged study over the microscope. This condition, of course, gives additional prominence to the cheek bones. His manner is one of retirement, and not at all calculated, at first, to inspire a feeling of ease on the part of those with whom he comes in contact. Later, however, this feeling gives place to a gradual and ever-increasing attachment. He is a man whose convictions are well defined, and adhered to with almost obstinate tenacity. He possesses the two qualifications essential to a successful mycologist—patience and perseverance. Combined with these is a rare trait, the ability to define one's own position clearly, to which, no doubt, a large share of his present success is due.—*Dr. Geo. W. Lewis in Independent Practitioner.*

LABORATORY NOTES.—The usefulness of a simple and inexpensive *eye-piece* micrometer as a part of the outfit of each microscope in the laboratory can scarcely be fully appreciated until one has tried it. When the student has at hand at all times a means for making accurate measurements, he will make many more records of measurements than when he has to call upon the demonstrator for a special eye-piece. A simple graded disk of glass which rests upon the diaphragm of the eye-piece is sufficient. It is of course best to have it in a second eye-piece, but in case the microscope has but one eye-piece the disk can be easily removed when not needed.

Cheap, and still efficient, *culture* cells for the growth of spores, pollen, etc., may be made by the use of the little vulcanite rings now sold by all opticians. A ring is fastened to a slide by means of gold size; when dry and firm, a little oil is spread upon the ring, and upon this the cover glass (bearing the hanging drops, in which are the spores,) is carefully laid, care being taken to secure an air-tight chamber.

Very frequently a student wishes to *preserve a specimen temporarily*, when he is obliged to leave the laboratory before completing his work. This he can do with most specimens by simply applying a drop of glycerin at the side of the cover-glass in such a manner as to effect a union between the water and the glycerin. The latter will slowly run under the cover-glass and preserve the moisture of the specimen often for many days.—*Chas. E. Bessey in Am. Naturalist.*

COMPOSITION OF STARCH GRAINS.—Now comes A. Meyer and denies *in toto* the Nägelian theory of the composition of the starch grain, viz: that it consists of two substances, granulose and starch cellulose intermixed. He concludes from his researches that in ordinary starch, which turns blue with the iodine test, there is but one substance, and that it is alike throughout, the layered appearance being due to the varying porosity. Starch which turns red with the iodine test has other materials mixed with the true starch-substance.—*Botanical Gazette.*

RAISING DIATOMS IN THE LABORATORY—Under this title Prof. Samuel Lockwood, Ph. D., communicates to the New York Microscopical Society Journal his investigations of some sea-water which had remained undisturbed for sixteen years in a demijohn in a dark cellar. At the end of that time, requiring some water for a *Sertu-*

laria sent him from the coast, Mr. Lockwood was greatly surprised to find various forms of diatoms in the jug-water. This led to a series of experiments and the following conclusions:

1. That diatoms originate in spores, or seed-like bodies.
2. These spores are exceedingly minute, passing easily through filter-paper.
3. They are probably resting spore, not motile, and may be held in suspension awhile like the mineral matter in turbid water.
4. The viability of these spores is remarkable. The diatoms raised in the first series of experiments were from spores whose life force had lain dormant in total darkness for thirteen or fourteen years; those in the second series for sixteen years.
5. The viability of some genera is greater than that of others. This is notable of *navicula* in these experiments, and is consonant with the numerical lead of this genus in forms or so-called species.
6. Owing to the environment becoming abnormal, development may be rapid and erratic to a surprising degree, but upon aberrant and asymmetrical lines. Suppressed at some points, the life-energy is precociously active at others.
7. Diatoms have embryonal stages or forms, with silicate fronds.
8. As to kind and quantity, the crops are capricious and vary without apparent reasons.
9. As to the parentage or begetters of the spores, in my experiences, they were not generated in the vessel which contained the water, but were begotten of sporangial mother-cells in the bay, (Raritan Bay).

NEED OF A BIOLOGICAL LABORATORY. —The *Western Druggist* says: There can be no question that the biological laboratories in Italy, Germany, France, Holland, Sweden, and all other European countries, have exerted, and are exerting, a profound influence on the study of natural history in Europe. In fact, many of our own best naturalists have received their training in German or Italian laboratories. It is gratifying to know that a strong movement has been initiated to revive and carry out Agassiz's cherished idea of a school on the Atlantic coast. Preparations for its establishment have already so far progressed that it may be counted upon as a certainty. Its distance, however, from the centre of population of the country, as well as the fact that it will be devoted mainly to the study of marine forms, will prevent many from attending. A biological laboratory for the study of land and fresh water forms is needed, and there is no better place for such a laboratory, none which, if it were well equipped and provided with a good corps of instructors, would

command a larger attendance than one here on the shores of Lake Michigan. It is a pity, with all the wealth that is in Chicago, the accumulation of which is largely the result of science, no one can be found to endow, out of his millions, a school for fostering so important a branch of science as biology.

RHIZOPOD-LIKE DIGESTIVE ORGANS IN CARNIVOROUS PLANTS.—Herren A. Kerner, v. Marilaun, and R. Wellstein v. Westusheim, describe the contrivances for the capture and digestion of insects in *Lathræa squamaria* and *Bartsia alpina*. [SB. K. Akad. Wiss. Wien., XCIII. (1886).] On the back of the underground non-chlorophyllaceous leaves of *Lathræa* are cavities, the inner walls of which are clothed with glandular organs of two kinds—stalked capitale hairs and sessile 2–4 celled sterile elliptical organs, the latter in connection with the vascular bundle system of the leaf. The outer membrane of both organs is provided with extremely regular perforations, from which, under certain circumstances, extremely fine protoplasmic threads project outwards. These threads come into contact with the products of decomposition of the animals (infusoria, mites, etc.), which perish in the cavities. No excretion of any special fluid could be detected. At the commencement of the period of vegetation, the absorption of nutriment in *Lathræa* takes place, chiefly through the haustoria, and the quantity of the remains of animals found in the cavities is extremely small. Towards autumn the haustoria partially disappear, and the number of insects captured increases.

On *Bartsia alpina* similar organs are found in peculiar hollows formed by the leaves, the margins of which are recurved in veneration. The leaf-buds are under ground, and the structure of the cavities is similar to that in *Lathræa*.—*Jr. R. M. Soc.*

ACTION OF ALGÆ UPON WATER.—According to M. E. Breal [Am. Agronom., XII. (1886),] the microscopic algæ in fresh water decompose bicarbonate of lime dissolved in the water, and thus give rise to a calcareous deposit. Being able to live in neutral or slightly alkaline liquids, they may, by the oxygen which they disengage, serve to oppose, or even arrest, putrefaction. They rapidly remove nitrates and ammonia from water, since these two substances supply the nitrogen necessary to their growth; in the dark, however, liquids charged with these algæ evolve ammonia.—*Jr. R. M. Soc.*

NEWS AND NOTES.

S. H. VINES, the eminent English botanist, has been given the degree of D.Sc. by the University of Cambridge, England.

MR. HENRY MILLS, of Buffalo, N. Y., recently read an interesting paper on fresh-water sponges, before the Illinois State Microscopical Society, an illustrated report of which appeared in the *Inter-Ocean* of May 30th.

DR. JAMES E. REEVES, of Wheeling, W. Va., is sending out a circular letter, in which he offers his services to physicians for the microscopical examination of pathological growths, fluids, etc.

A WORK has recently appeared, by Jacksch, of Vienna, on "Clinical Diagnosis of Internal Diseases by means of Bacteriological, Chemical, and Microscopical Methods of Examination." Urban & Swartzeberg are the publishers.

THE latest theory, for which Galippe and Landouzy are responsible, is that uterine fibroids and ovarian tumors are the result of microbic action on the tissues.

THE death of Dr. Carl Friedlander, of Berlin, is announced. He was well known for his contributions to the literature of pathological anatomy, and as the editor of the *Fortschritte der Medicin*. Dr. Friedlander's name in connection with the pneumococcus is familiar to every bacteriologist. His age is given as forty years.

THE *Scientific American* of June 18th contains an excellent portrait and sketch of Alexander Agassiz, the distinguished son of an illustrious father.

DR. JOSEPH LERCH, Extraordinary Professor of Zoology, and Director of the Zoo-Chemical Institute in the University of Prague, is dead.

THE edge of a lamp flame is said to give about four times more light than the flat flame.

MR. W. H. BREARLEY, well known for his interest in microscopical matters, has become president of the Detroit *Evening Journal* Company.

MR. S. W. RIDLEY has recently described the fourth species of fresh-water polyzoon, *Lophopus lendenfeldi*, found in Australia. This was found near Sydney, N.S.W.

At a recent meeting of the Philadelphia Academy of Sciences, Professor Ryder called attention to the existence of pathological growths in the lower animals, and described a lobulated tumor from the heart of an oyster; a mass of organic tissue formed in the fore part of a shad's alimentary canal; and the degeneration of the Wolffian bodies of a goldfish.—*American Naturalist*.

DR. G. M. STERNBERG has been designated "co-laborer" in this country of the *Centralblatt für Bacteriologie und Parazitenkunde*, and requests authors of papers on bacteriology, which contain original research, to send to him duplicate copies, which he will forward to the editors of the Journal. Address Dr. Sternberg, John Hopkins University, Baltimore, Md.

BOOK REVIEWS.

MUSCULAR TISSUE, by Simon H. Gage. Reprint from Buck's Reference Handbook of Medical Sciences.

This is the clearest and most complete description of muscular tissue with which we have met. We notice that most of the cuts illustrating the article were drawn by Mrs. Gage.

BULLETIN OF THE CALIFORNIA ACADEMY OF SCIENCES, Vol. 2, No. 7; June, 1887.

Contains besides other valuable papers a list of the desmids of the Pacific coast, identified by the Rev. Francis Wolle.

PLANT ANALYSIS AS AN APPLIED SCIENCE, by Helen C. DeS. Abbott; reprint.

A valuable contribution on an interesting and important subject.

WIDE AWAKE, September; D. Lothrop & Co., Boston.

ON THE USE OF THE AMPLIFIER, by Geo. W. Rafter. Reprint.

CYCLIC ALBUMINURIA, by William Buckingham Canfield. Reprint.

INTUBATION OF THE LARYNX, collected reprints from the Medical Record.

PROCEEDINGS OF THE AMERICAN FORESTRY CONGRESS, September, 1885.

ALATYPES OR STENOTYPOGRAPHY, a system of condensed printing, by Henry D. Brown.

THE INCONSISTENCY OF OUR CODE OF DENTAL ETHICS, by Dr. C. H. Land, Detroit, Mich.

CORRESPONDENCE AND QUERIES.

PAW PAW, MICH., Sept. 15, 1887.

THE MICROSCOPE, Detroit, Mich.:

Please give, through the columns of THE MICROSCOPE, directions for cleaning diatomaceous earth, and also for mounting the cleaned diatoms without matting. Yours truly,

E. B. DUNNING.

PER J. C. D.

[We shall publish, at an early date, an interesting paper on collecting and cleaning diatoms, by Mr. K. M. Cunningham, of Mobile. Matting may be prevented by the method given in Technology, p. 151, May, 1887.—EDITORS.]

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be given ONE INSERTION FREE OF CHARGE. Dealers are referred to our advertising department.

FOR SALE—Beck Popular Binocular with complete outfit, 2-in., 1-in. and $\frac{1}{4}$ ob. polariscope, parabola, double nose-piece, 3 sets eye-pieces, etc. in perfect order, only tarnished. Price, \$80. Address WM. H. SEAMAN, Patent Office, Washington, D. C.

WANTED—To buy the numbers of the *American Journal of Microscopy* for July, 1876, and May and September, 1881. Will pay 25 cents each for them. Address C. C. MELLOR, 75 Fifth Ave., Pittsburgh, Pa.

WANTED—B. eye-piece (to fit Bausch & Lomb's smaller stands), a camera lucida, a stage micrometer (metric preferred) and a good turn-table; also Carpenter, or Beale, on the Microscope. Will exchange for above, books on Mineralogy and Chemistry and general literary works. Correspondence solicited. A. F. BARNARD, Box 153, Oberlin, O.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,

At 32, 34 and 36 Seitz Block, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 25 Washington Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. Box 583, Detroit, Mich.

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VOL. VII.

DETROIT, NOVEMBER, 1887.

No. 11

ORIGINAL COMMUNICATIONS.

"DISEASE GERMS." ANOTHER ILLUSTRATION OF THE FACT THAT BACTERIA CAUSE DISEASE.*

BY T. J. BURRILL, PH.D.

NOTWITHSTANDING the numerous demonstrations of the active agency of micro-organisms in the production of disease, especially in animals, doubts are still expressed upon the subject, in private interviews and in public prints. If these skeptical or combative utterances did not frequently come from those who are considered, however worthily, to a greater or less extent, authorities upon such matters, further contributions to the exposition of the truthfulness of the so-called germ theory of disease might not be considered necessary or useful. But there are to-day honest skeptics upon the subject who really wish for reliable information. Whether or not they have made reasonable use of the published accounts of experiments, whether or not they have embraced possible opportunities to experiment and investigate for themselves, need not now concern us. One who is convinced of a truth ought not to stand upon his dignity about publishing and republishing his reasons for the faith that is in him. There are other skeptics in the matter who apparently will not believe evidence, on account of some previous occupation of the mind with other notions, the mental capacity, perhaps, not being sufficient for two ideas at the same time, and the

*Transactions of the American Society of Microscopists, 1887.

mental inertia (if one may so speak) too great for change when once started. As these latter intellects are not to be looked for within the membership of our organization, nothing further need be said here to meet such opposition. To the former, if present, this communication may possess something of interest.

We certainly have some advantages, in investigations of this kind, in dealing with vegetable instead of animal bodies, on account of the comparative simplicity of structure and physiological function in the former. In plants, each cell is, in an important sense, an independent physiological unit. One can cut a section from a living plant, for microscopical examination, and keep it under his eye for hours, while it retains its normal vital condition and activities. There is no nervous system to complicate the problem, and perhaps lead one to false conclusions, as to the actual cause of the phenomenon presented. In plants, there are no so-called constitutional affections, like chills and fevers. Disease is always local, at least in origin. If other parts are ever involved in consequence, it is only in a mechanical or physical way, as when, by the want of proper root action, the stem and leaves may suffer from the want of water, and not at all through sympathetic communication. Then, again, the structure of vegetable tissues is such that the elements can be much more readily examined by themselves. The cells are larger and more distinct, as well as more permanent; the difference between wall and contents is greater, and the entire cell-structure is easier identified and examined.

To be sure, comparatively little has been done in the investigation of plant diseases due to bacteria, but this is sufficiently explained by the relatively few workers upon this department of plant pathology. While the earliest known disease of this kind upon plants was first announced in our country and to this society, there have been recorded in America, aside from the writings of the author, the results of but one series of careful investigations upon the relations of bacteria to vegetable disease, and these upon the same subject as that first presented, viz: the so-called fire-blight of pear and other pomaceous trees.

This is by no means for want of opportunity upon the material side. There certainly are enough plant diseases of the nature in question to furnish abundant chance for investigation. The failure is wholly upon the part of the investigators. Man's body is animal, not vegetable, in make-up. This in itself is sufficient to give extra

stimulus to the studies upon the former kind of structures. There are hundreds and thousands of active workers whose professional business it is to deal with diseases of animals and man, and hundreds of special schools where instruction is directly imparted to students upon their diseases; but the professional vegetable pathologists are yet to be evolved, to say nothing of special schools for their training. Yet the time cannot be far distant when critical investigations will be made upon vegetable structures for the very purpose of helping towards the solution of the problems presented in animal pathology. This has been recognized by Sir James Paget, whose paper upon the subject is interesting reading. As a contribution to the general doctrine of "disease germs," as well as for the intrinsic importance of the new results herewith presented, this paper is respectfully submitted.

During several years, complaints have been made by those who grow crops of broom-corn and sorghum (*Sorghum vulgare*) of an injury especially evident upon young plants, but also upon those of any age, whereby great losses have occurred. Sometimes the unwelcome appearances of disease are confined to definite but usually irregular areas, and often within these areas the entire crop is destroyed. In other cases, the diseased plants, in greater or less numbers, and in various conditions of injury, are distributed throughout the field, smaller in size than the healthy ones, if any, and of a general sickly appearance. The lower leaves of the affected plants gradually die, but are first spotted and splashed with crimson-red, in all sizes and shapes. This conspicuous coloring is more particularly observed upon the upper portions of the leaf-sheathes which invest the stem, and, to a less extent, along the mid-veins of the leaves. The stems themselves are not commonly damaged locally in a serious manner. If the stalks live to develop the brush or seed panicle, the peduncles or wiry stems of the latter are often badly scarred with irregular reddish patches. These may often be seen in manufactured brooms.

Upon examining the roots, many of them are found dead. The affected plants are easily pulled up, often yielding to very slight force, while their healthy neighbors resist a vigorous pull. The oldest roots die first, and, as others are gradually emitted from the lower part of the stem in successive circles, in the well-known order with these plants, they become successively diseased and die, so that only the youngest, or those emerging highest up on the stem, are still alive. There are no abrasions of the surface. As far as can be

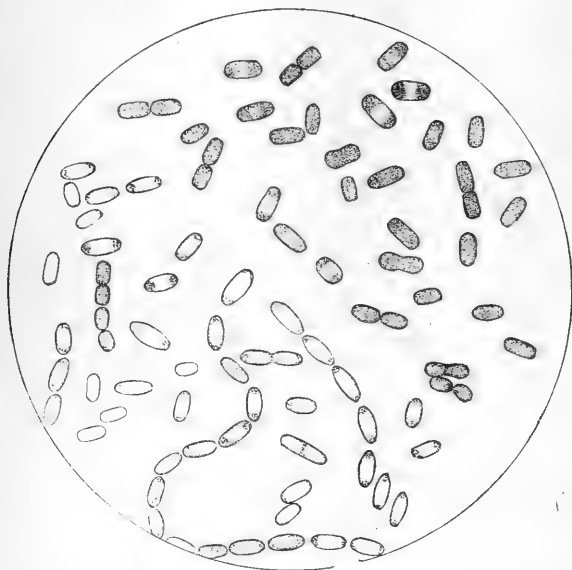
made out with a hand magnifier, the tissues, both of the leaves and of the roots remain intact, until dead and dry, when the affected parts soon crumble away. It seems to be only the exterior layer of tissue or cortex of the roots in which the disease is resident.

The injurious effects, now described have been attributed to insects, and to parasitic fungi, to unfavorable conditions of soil and of climate, and to constitutional weakness of the plants themselves. The crops are not comparatively important ones in the country at large, and are usually locally cultivated, so that relatively little attention has been given to them by scientific investigators. But an account of careful studies upon the diseased condition of the plants and upon the insects infesting the fields is given in the Thirteenth Report of the State Entomologist of Illinois (1883), by Professor S. A. Forbes. These studies were avowedly unsatisfactory, but finding great numbers of plant lice, of four distinct species, in the fields, it was thought these, or some of them, probably caused the mischief. If, however, the injury could be assigned to the lice at all, Professor Forbes concluded that the main damage must have been done before the time of his examination, and that the depredating insects had largely disappeared, for their distribution at the time did not correspond with the evidence of damage done. He thought the trouble might be due to fungi, and specimens were sent me for examination, upon which a negative report was made. I am not aware that the injury in question has elsewhere been attributed to specified insects.

In the *Prairie Farmer* for August, 1884 (Vol. lvi., p. 532), I gave a description of a fungus supposed to be an unnamed species of *Chaetostroma* found in abundance upon affected leaves of broom-corn. This seemed, at the time, to cause at least some of the damage noted. It has been found several times since, and probably does injure the crop, but cannot be connected in anyway with the main disease with which we are now concerned.

This completed, so far as I am informed, the accounts that have been published having reference to the particular and conspicuous injury at present under discussion. If the references really are complete, we can understand that very little has been known upon a disease which has certainly existed at least six years in our country, and which was probably imported from abroad with the affected plants many years ago.

In July, 1886, I collected for microscopical examination some of the diseased plants, and, upon using higher magnification than formerly, found numerous bacteria within the cells of the affected parts. An assistant, Mr. Charles Woodworth, was then asked to make special experiments and observations. The results were speedily convincing that a specific micro-organism was in some way connected with the disease, and, apparently, as an active agent in its production. But for some reason, still unknown, after August 1st, 1886, the culture experiments undertaken were not successful, and the matter was dropped for the time, on account of other work. A pure culture of a *Bacillus* had, however, been made from the affected plants, and the disease was experimentally produced by the use of this artificial culture. Sterilized-water was used in exactly the same manner as a check upon the former.



Wishing to ascertain the conditions of things in the winter, some broom-corn seed was planted in February, 1887, in the green-house, and April 6th, 1887, Mr. M. B. Waite, a student, under my advice, commenced inoculation experiments upon the young plants with material taken from old diseased stalks, obtained at the time from the field. This old stalk contained, in great numbers, living microbes, though it was frozen hard when collected. There were also many spores recognizable by their peculiar refractive properties and uniform shape. The cultures from this old material were not always

pure, but the prevailing organism was a *Bacillus* of apparently the same microscopical and culture characteristics as that found the year before. This organism was easily obtained in a state of purity by plate cultures, and also was found to be pure in several direct transfers from the old stalk, care being taken to effect this result.

The inoculation experiments upon the young plants were at once successful both from macerations of the old diseased stalk, and from pure cultures of the *Bacillus* mentioned. Checks were made upon the same or similar plants by the use of sterilized-water, and of sterilized beef-broth, like that in which the cultures were made. Studies were prosecuted until the first of June, when they were again interrupted, to be resumed a month later.

Without pausing now for the records of single experiments, a general summary of results is presented.

In the described disease of broom-corn and sorghum, a specific *Bacillus* is constantly found in the affected tissues, both of the roots and of the aerial parts of the plants. Pure cultures of this *Bacillus* may be made in beef-broth, and in infusions of potatoes, and of maize kernels, as well as upon nutrient gelatine and agar agar. The best growth takes place at a temperature of about 36° to 37° C., but development proceeds more slowly, as the temperature is reduced below 25° C. Still lower temperatures were not tested. In potato infusion, in a test-tube, inoculated with a minute amount of a previous culture or directly from the diseased tissues, and placed in incubator at 36° C., the limpid fluid becomes sensibly turbid in twelve hours, and in twenty-four hours conspicuously so. In the latter case, spores may be sparingly found. These are produced in a characteristic and uniform manner, one in the middle of each cylindrical segment of a chain, or in the individual microbe if separated. There is some undetermined condition under which the chains of cohering organisms are formed, for in some cases this is the prevailing form, while in others, apparently similar, the individuals are separated. In the most active stage of growth—say at twelve hours under the above conditions—the organisms are almost uniformly in pairs. In the preparation for spore-formation changes take place in the protoplasmic contents of the cells, indicated by the action of staining agents. During active growth, methyl-violet stains, uniformly and deeply, the whole body. When spore-formation begins, the central area of each cell is noticeably paler. At first, this lighter colored portion looks like a pale indistinct equatorial band or zone without distinct limitations. Gradually the differentiation becomes

more pronounced, until one sees a cylindrical cell with a dark spot in each end, and a comparatively large white central area. By very careful examination, however, an exceedingly delicate film, seen in optical section as two fine border lines, can be made out as a lining of the cell-wall throughout the white area. Sometimes the dark-end spots appear like circular dots, but usually conform to the external shape of the cell, and are concave on their inner sides, or on those looking towards each other. These spots grow gradually smaller but do not wholly disappear, at least in many cases, until the cell-wall dissolves, and leaves an oblong free spore entirely colorless, except, perhaps, at the ends, where the violet stain still leaves its mark. When still older, this agent does not color the spores. Aniline red, with carbolic acid, does stain them. The *Bacillus* averages $.7\mu$ in transverse diameter, but varies from about $.5\mu$ to 1μ . The joints are short, but run from 1 to 3μ in length, 1.5μ being more common. When, as pairs, newly divided, the segments are oval, but usually the shape is short, cylindrical. As the spores form, the sides become convex, so that the outline is elliptical, the ends, however, remaining obtuse, or semi-circular. During the period of active growth, the organisms have flagellate motions, but these are never very rapid compared with many others, neither does the power seem to be long retained.

On plate cultures, the characteristic growth is white, or pearl-like, with peculiarly lobed and fimbriated margins. Gelatine is not liquified. In liquids, in the incubator as described, a pellicle forms upon the surface within twenty-four hours, but afterward becomes thicker. It is white, or nearly so, usually polished or glazed above, with characteristic granules and pits. The growth extends upward on the sides of the test-tube about three millimeters. After a time the pellicle becomes brittle, easily breaks up and gradually settles to the bottom as a flocculent precipitate.

When some of the culture-fluid, filled with the microbes is smeared upon the upper or under surface of healthy leaves of broom-corn or sorghum, after forty-eight hours, minute red specks can be seen by the unaided eye. These specks are usually thickly dotted over the entire area to which the application was made; but, sometimes when the fluid settles more upon a given portion of the leaf, the spots are conspicuously more abundant there. By the aid of suitable magnification, it can be readily determined that the minute red specks owe their location to the stomates or breathing pores of

the leaf. If a leaf is previously marked off by ink-line into equal areas, say two inches wide, and, upon alternate blocks is painted, in one case a fluid containing the *Bacillus* described, and upon the others, a sterile fluid of similar kind, the results are very striking and convincing. We find the former set speckled throughout with the red dots. At a later time, say four days, the peculiar checked appearance of the leaf corresponding to the treatment named is conspicuously manifest, though not all of the tiny red dots subsequently enlarge. The infected surface becomes irregularly blotched. If now a portion of such a diseased leaf is slightly flamed, then cut with a flamed knife, so as to divide the epidermis and start a crack in the tissues, when the leaf is bent, a freshly broken exposure of the diseased parts can be secured. A glass pipette just from the flame can now be thrust into the newly-exposed reddish tissues, and a culture started with pretty strong presumptions that whatever growth results, comes from the infected leaf. In this manner, time after time, a pure culture of the specific *Bacillus* has been secured, and from these cultures the disease has been again started. Moreover, the *Bacillus* itself has been found numerous enough in the affected tissues, both when the disease occurred spontaneously, that is naturally, and when artificially started, as described.

But I have not yet learned to exhibit satisfactorily bacteria *in situ* with vegetable tissues. No stain or method of decolorizing has been found serviceable in these cases. Then, too, the sections must be so thin that the cells themselves are usually cut and the contents escape. If infiltrated the mass interferes, or, if the latter is dissolved the organisms are likely to be washed away.

If sections are made of a newly-infected leaf, it is easy again to demonstrate that the disease starts at the stomates. The guard cells themselves may or may not be changed, but the cells immediately beneath the aerial cavity show the initial influence of the disease. From the stomates the injuries spread downward and sidewise. In thus spreading, originally distinct spots coalesce and form continuous blotches, as described.

The cell-walls are in no wise altered, so far as can be made out by microscopical examination, except that they are stained throughout with red instead of their normal clear white. The first change observed in the cell-contents is a shrinking of the protoplasm, as when treated with alcohol. It separates from the wall of the cell, and appears rigid instead of the usual plastic consistence in health. The chlorophyll granules, if present, lose their green color and break

up into granules of much smaller size. The mass continues to shrink and becomes tinted with red. From this time, on, the change does not appear to be always the same. Sometimes the shrunken mass seems tough, and remains like a lump in the middle of the cell. In other cases, it breaks up into granular debris immersed in water. If starch grains existed, they share the fate of the other material and are decomposed. At length the substance passes into what seems to be an emulsion of oily matter in water. The spherical particles are dark red and usually exhibit Brownian or molecular motion. In certain cells minute starch grains, of uniform size and shape, like little double-convex lenses, occur in great numbers and oscillate rapidly in the watery cell-fluids. These may be easily mistaken for microbes, but iodine stains them blue. They have been observed only near the borders of the diseased areas, within the parts which have turned red. Finally, little or nothing remains within the inclosure of the cells; the surfaces of the wall, however, usually show what seems to be a granular or dirty deposit clinging to them. The cellulose of the cell-walls is stained beyond the area penetrated by the microbes. The liquid itself in the diseased cells is red, colored thus by some soluble substance, perhaps a compound of tannic acid.

No attempts have been made to ascertain the chemical changes that take place either in the cultures or in the plants; but it is evident from what has been said that the injuries are chemical rather than mechanical. As before indicated, the effect is, at first, at least purely local. It seems, however, quite probable that cells adjoining the invaded ones sometimes suffer from the absorption of the liquid only of the diseased parts. It indeed may be true that the protoplasm which shrinks into a lump and remains unchanged otherwise in the cell is killed by the poisoned liquid, and not by the direct action of the microbes. The latter have not been observed in such cells. The red coloring-matter is not directly elaborated by the organisms, but results from the chemical decompositions of the cell-contents. The bacteria themselves are white, and do neither absorb nor excrete the red stain. No culture fluid tried is changed in color by them.

The question is sure to be asked, "What are you going to do about it?" The so-called practical man is very apt to say: "I care nothing about the cause. Tell me the cure." It is not always easy to say how an enemy can be safely met when he is seen; but it is true that a known foe is himself more exposed than one who fights under cover. The knowledge of the cause may lead to the cure.

If we concisely review the facts, remedial practices may be suggested. The destructive organisms infest any or all parts of the plants and live over winter, either as spores or otherwise, in the old material. In the case of broom-corn, there is a large mass of this old substance left upon the ground, and it has been observed that since the improvement of plows permitting this refuse to be turned under, the disease has been much more destructive than when it was necessary to clear the ground by burning the old stalks. Undoubtedly, one thing to do now is to return to the former practice, and carefully burn the stubble. But this does not dispose of the old roots and underground parts of the stems, which are infested with the parasites. Rotation of crops is better than trusting to burning, and field practice has given excellent demonstration of the utility of this system of management. Crops are sometimes injured on land not previously planted with sorghum or broom-corn; but the injury is invariably greater, so far as direct observation has been made, when successive crops of these plants are grown on the same land. The same microbe does not appear to affect maize, wheat or oats, though it is probable that it does live and prey on some other members of the great grass family. The most serious damage is done to the roots, and, no doubt, these are far more liable to be infected from organisms already in the soil than from such as might be washed down into fresh ground by rains. If the soil, on the other hand, contains great numbers of the living microbes, many of these will get into the air by the evaporation of water from the infested earth. This fact has been disputed, but experiments have repeatedly shown that bacteria may be carried over in the practice of distilling water, as well as disseminated in natural evaporation. Whether they ride on tiny droplets, or are simply moved by the aerial currents produced, we need not stop to inquire. Their own power of movement is of course useless for such dissemination as we now consider.

It is quite possible that special fertilizers may be of service in checking the ravages of this disease, but nothing upon that subject is known. There seems to be no difference in regard to the general fertility of the soil. Indeed the more luxuriant the growth, the more conspicuous the appearance of disease upon artificial infection. Moist weather also seems favorable to the spread and abundant development of the malady. Rains appear to be efficient agents in the natural infections. During the unusual dry weather of the present season the crops suffered little, comparatively, in the partic-

ular manner in question. Nothing has been noticed as to the difference, if any, in the different varieties in regard to the liability of infection. Very probably there is some variation in this respect.

According to the tenth census of the United States, there were produced in 1879, 12,792 lbs. of sugar and 28,444,207 gallons of molasses from sorghum, and 29,480,160 lbs. of broom-corn. Counting the sugar at five cents per lb., the molasses at thirty-five cents per gallon, and the broom-corn at one hundred dollars per ton, and estimating the loss from this disease as five per cent. of the entire sum, which is certainly far within the actual amount, we have \$571,506.00 as an annual tribute laid upon these comparatively unimportant crops in our country by the microscopic invaders, belonging to a single company of the mighty host which we are just beginning to recognize as warriors and enemies. Is it not time that we were opening our eyes and bestirring ourselves for a determined engagement? Victory ought to be, and may be, ours.

Having now presented the chief results of these investigations, permit me to recall attention to the fact that this plant disease is started by simply placing the living microbes on the healthy leaves. There is no wound of any kind as a prerequisite. There is no preliminary letting down of constitution vigor. The action of the bacteria is direct and indisputable. They, and they alone, must be considered the agents of the injury. It is by no means asserted that this is the first time such proofs have been offered, or that the work in this case has been exceptionally well done from the standpoint of general bacteriology; but, upon the principle of line upon line, the results must help to strengthen testimony already strong.

It only remains to introduce the new member of the family of known microbes as *Bacillus sorghi*, n. sp.

CHAMPAIGN, ILL.

COLLECTING AND CLEANING DIATOMS.

K. M. CUNNINGHAM.

MY apology to the readers of THE MICROSCOPE for adding another article to the many that have preceded, in relation to the subject title at the head of this, may be found in the receipt of a flattering invitation, coming from the managing editor, to contribute an article of this nature. During the past six months I have given very close attention to the subjects of collecting and cleaning, or preparing, the diatomacere. So much so that I enter, without hesitancy,

upon a description of my methods, feeling the utmost confidence in the reliability of the results obtained. Having, likewise, given the study of the diatomaceæ preference over all others requiring the application of the microscope, whether for purposes of pleasure or of profit; it is, therefore, in this branch that I am most interested, and from the very inception of my studies, I have had in view the accomplishment of a definite end, namely, to elaborate from all possible and available sources as complete a table or synopsis as is possible, of the various genera and species of the Diatomaceæ occurring within a radius of at least fifty miles of the city of Mobile. And as, during the past ten years, I have availed myself of such opportunities as were presented to collect or secure material yielding diatoms, I will enumerate some of the sources drawn upon.

The chiefest among these are the marine muds of Mobile Bay and the Gulf of Mexico; the marine muds also presenting the greatest difficulties to be overcome in their preparation as a source of diatoms for study or for exchange. Also, the sedimentary muds, and water plants of every accessible local river, creek, bayou, lake, swamp, marsh, pond or spring, and even ditches; each contributing its quota of species, in various combinations or associations. Among the more novel sources may be mentioned the "guano" of the living sea gull and the gizzards (so called) of the mullet fish, both affording diatoms in great profusion, and, not to overlook the latest found source in my experience, the ancient marsh mud, on which rests the alluvium, upon which the city of Mobile is built. This stratum was met with at a depth of five feet below the level of the streets bordering on the river. I think I can safely say that through my exertions in prosecuting this "labor of love" I have been able to demonstrate the occurrence of at least three hundred distinct species of diatoms closely tributary to this centre, and of which I have preserved mounted slides for future reference or use, in concluding my primary object. The first requisite in the preparation of marine diatoms is to secure a quantity of mud, and the subsequent treatment as pursued by the writer is as follows: Take at least half a pound of hard or soft mud to begin on, and soften it into a uniform liquid paste, and, to hasten and assist its liquidity, add about a teaspoonful of aqua ammonia, which liquid will be useful under all circumstances in the initial steps of cleaning, as it cuts and dissolves slimes and gelatinous impurities, and cleans the sand grains, and enables the bulk of the material to be cleaned to settle quickly and compactly, as well as having distinct lubricating properties. Next, transfer the

liquid mud to a suitable vessel of tin or china, of at least six or more inches in diameter, and not over five or six inches deep, put therein as much liquid mud as will fill one inch in depth, and fill up the vessel with clean water, and stir rapidly the contents to liberate the flocculent matter from the heavier contents; after allowing the contents to settle for ten minutes, by the watch, with a section of drop-light rubber tubing at least eighteen inches in length, siphon off the water to within half or three-quarter inches of the bottom of vessel, renew the water and then stir up quickly, and after five minutes siphon off the water, with the aid of the rubber tube, to within half an inch of the bottom. At this point a material portion of the mud has been removed, which it is not essential to treat further. The sediment left, after siphoning off the water the second time, is transferred to any shallow tin or other vessel for convenience.

The next step is to place in a shallow concave glass, which may be secured at any photographer's, it being used by them for crystal photographs, the size about four by six inches,—a shallow layer of the diatom-bearing mud, and adding water as a top layer, gently gig the glass back and forth making the waves run from end to end, and side to side, and tilting the off or front end. This manipulation forces the large and small sand-grains to densely cake and pack together, and, at the same time, forces to the surface a large percentage of the diatoms, and most of the vegetable debris. After a few moments of gigging, the surface fluid is gently poured off and caught in a separate settling vessel, and the heavier sand dropped into a waste receptacle. It might here be observed that a very small percentage of matter would be the outcome of the first manipulation, as detailed, and that the bulk of the material was removed from the crystal glass as rejected sand; it can generally be relied upon, that what is left on the gigging glass would not do to manipulate again, and the diatoms must be looked for in the light, coherent, flocculent and vegetable debris matter that floated over in the first removal of the surface fluid. Repeat substantially the same manipulation until the whole of the mud has been gone through with, and when, finally, what is left of the half-pound of mud as started with is collected together, it will appear very little, indeed, but the coveted gems are therein, or do not exist in the mud. The next step is to transfer what has been saved in the various partial concentrations, and transfer all of it to the crystal glass, and add clean water and gig it again several times in succession to remove additional sand, and to get a further concentration of the desirable

material. An occasional wet test under the microscope will show whether the indications of diatoms are good: if so, the material is then transferred to a small holder with a spherical bottom, so that it may quickly settle, and with a rubber bulb pipette, all water is carefully removed. Should there appear to be about a half-inch deep of the material as the result of all previous manipulation, add to it an equal bulk of sulphuric acid, intimately mix, and by the aid of the pipette, transfer it to a half or three-quarter inch diameter glass test tube of about six inches length, boil it for fifteen minutes over a candle, or a spirit-lamp flame: in that length of time it is probable that all organic matter therein will be reduced, or carbonized. At this juncture, add carefully, a drop at a time, several drops of nitric acid, and boil continuously for ten minutes longer, when it will soon be noted that the blackness is discharged, restoring transparency to the boiling fluid, a partial or complete bleaching of the material and a remarkable reduction in volume. If there has not been a complete reduction of all vegetable or other organic matter, it may be necessary to add a few drops more of sulphuric acid and boil it a while longer. Should the preparation at any time not yield satisfactorily to the bleaching process, pour out the contents in a spherical bottom vessel, and allow time to settle, pipette off the acid, and add a fresh quantity of sulphuric acid, and boil a few moments, and finally add a few more drops of nitric acid to oxidize the remainder of the carbonized substances.

All acid-boiling processes should be conducted in an open fire-place if practicable, so that the irritating gases may pass up the chimney and not vitiate the air of the room, or fill it with an unpleasant odor. The above apparently long or double boiling process is rarely required, but must be resorted to if the organic material to be reduced is refractory. Where boiling first in sulphuric acid, and later adding nitric acid is applied to the cleaning of all diatom gatherings not badly mixed with sand or vegetable debris, or, as applied to the cleaning of pure gatherings, it acts very rapidly, giving promptly a snowy white cleaning of the diatoms. In the case of the marine or fresh water diatoms, a final bleaching may be accomplished by pouring the diatoms while still in acid into a shallow and contracted china or glass saucer, and adding thereto a few drops of Darby's prophylactic fluid, which actively effervesces and liberates the bleaching gas. While the boiling alone, first in sulphuric acid, and later adding some nitric acid, will be sufficient, yet a greater whiteness is produced by the addition of the prophylactic fluid as a bleach-

ing substance. The boiling process above described dispenses with the addition, during the cleaning, of any powdered crystalline salts, and is also operated with a minimum of acid fluids. And to purify the diatoms from acids, it is merely necessary to allow the preparation to settle a few minutes, and carefully draw off the bulk of the acid and allow the diatoms to settle in shallow china saucers, half an inch deep preferably; draw off and change the water after one minute intervals, and repeat for four or five changes. A trial test made on a slide dried over a flame will show that all acid has been removed from the diatoms. At this stage, we have a rich concentration of the diatoms, but included therein some sand grains and flocculent soil; the flocculent matter is removed by repeated shakings and settlings through a few inches in depth of clean water at three minute intervals, until, when tested under the microscope, a satisfactory appearance is reached.

The acid-cleaned diatoms are again transferred to the crystal gigging glass, and water added, and then very gently giggered for a final concentration of the diatomaceous forms, and a further portion of fine sand removed. The finishing touch to the cleaning for concentration of the forms is done by placing a small quantity of the acid-cleaned and concentrated diatoms into a concave black or dark glass, such as is used in tourists' eye-glasses, and the contents gently oscillated from side to side and to and fro, when the diatoms will be found very richly aggregated on the centre of the containing glass; the glass is then tilted and the diatoms removed by the gentle suction of a pipette, the dark glass enabling the mass of diatoms to be distinguished from the fine grains of sand adherent to the bottom of the glass. In lieu of the dark concave eye-glass, a deep bull's-eye watch crystal makes a good substitute for the final act of concentration.

Diatoms are also richly concentrated from sand by simply spreading the containing fluid over either a six inch square of smooth or ground glass, and gently giggering it while tilting it in the direction of one of the corners, and allowing the fluid to run off into a proper receptacle. A large percentage of the sand grains remain in situ, or adherent to the glass surface. I have made no allusion to boiling in alkaline solutions to neutralize traces of acids or for any other beneficial purposes, as I have not found it at all desirable or necessary to do so. There are a variety of further useful suggestions that I might enlarge upon, especially as to the uses of

flannel and silk strainers or sieves for the final cleaning and separation of diatoms, but the length of this article precludes doing so.

The various steps given in detail herein are *really* essential to success in cleaning the diatoms derived from sands or muds, and ought to be *strictly* followed, and when once mastered become as agreeable and interesting, and possess the same fascination as is usually allied with the arts of Magic.

From "collecting and cleaning," I should like to place before the readers of THE MICROSCOPE the Arcana, or wonders of the expert and artistic preparer of Diatom chef d'ouvres, or master pieces, a few of which I possess, and the mysteries of whose preparation I have from one of the greatest of artists.

MOBILE, ALA.

PROCEEDINGS OF SOCIETIES.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE regular semi-monthly meeting of this Society was held at its rooms, 120 Sutter street, August 24th, 1887. President Wickson occupying the chair.

Dr. Harkness made a preliminary report on the kelp covered by mollusca, which was referred to him at the last meeting. A more complete examination of the material will be made in due course.

The resignation of A. H. Breckenfeld, offered on account of his approaching departure for San Diego, was accepted. President Wickson spoke feelingly of the exceedingly pleasant relations which had always existed between the retiring officer and the Society, and at the conclusion of his remarks a cordial vote of thanks was tendered Mr. Breckenfeld for his services as Recording Secretary. Under a suspension of the rules he was duly elected an honorary member of the Society, and thereupon fittingly expressed his appreciation of the honor conferred. His successor will be elected at the next meeting.

A piece of wood, apparently fossilized, was sent in by Geo. A. Raymond, with the information that it had been struck at a depth of 325 feet in an artesian well now being bored in Kern county, Cal. The overlying material was mostly clay, and the surrounding country was entirely destitute of timber. After an interesting discussion the specimen was referred to Professor Hanks for microscopical examination.

Dr. Riehl donated a slide of a very minute larval form of insect, in which the vascular system was particularly clearly shown.

A varied assortment of entomological, botanical and mineralogical specimens was donated by F. L. Howard, who had collected them on the slopes of Mount Shasta. Some peculiar varieties of porous obsidian attracted much attention.

Mr. Riedy stated that the work of stamping the books, plates, etc., in the library, with the cut recently adopted by the Society, had been commenced and would soon be completed.

The meeting thereupon adjourned to the 14th prox.

A. H. BRECKENFELD, *Secretary*.

AMERICAN POSTAL MICROSCOPICAL CLUB.

AFTER the usual summer vacation, the work of the Club is now being resumed, and the boxes will be started in a few days. By withdrawing many of the old boxes it is hoped that the average quality will be materially improved, and an effort will be made to circulate an increased supply of Cole's or other professional work.

Printing is now in hand and arrangements are being made for the coming season; and any changes of address, or other business of importance in this connection, should be reported *at once* to the Managers, 53 Fourth street, Troy, N. Y.

ST. LOUIS CLUB OF MICROSCOPISTS.

THE regular monthly meeting of this Club, held at the College of Pharmacy, Tuesday evening, October 11, was devoted to the entertainment of the students of the College, who had been invited to be present. A very enjoyable time was had.

The next meeting occurs Tuesday evening, Nov. 1.

ELEMENTARY DEPARTMENT.

NINTH LESSON.

“CLEANLINESS IS AKIN TO GODLINESS.”

CELLS.—A cell is formed by interposing something between the slip and cover-glass, thus allowing a space for the specimen and mounting-medium in which they are partially or entirely relieved from pressure. The object of a cell then is to prevent the disarranging or crushing of the parts of the specimen

through the weight of the cover-glass, or to protect it from the force due to the subsequent contraction of the mounting-medium, brought about through the evaporation of its generally volatile solvent whilst drying. In working with animal tissues, however, the employment of a cell for the purposes mentioned is seldom required. The writer is of the opinion that if the specimen be sufficiently thin and properly mounted in a balsam which contains not too much solvent, no disturbances of the above character will ever occur to effect any appreciable change in the arrangement or appearance of the cellular elements. When it is desired to mount sections of considerable thickness, a cell will be found very useful if not necessary. The disadvantage of the cell is that it precludes the use of high powers in the study of the specimen. It not only protects it from violence but from a too close scrutiny as well. To overcome this disadvantage as much as possible a cell should never be any deeper than is absolutely necessary; in fact a theoretically perfect cell should be exactly as thick as the specimen to be mounted. This, of course, is practically impossible, though an attempt should always be made to attain this perfection.

CELL-BUILDING.—One of the most simple and oldest ways to make a cell is to take a piece of tissue-paper, or of thicker quality if desired, cut it to the size and shape of the cover-glass, punch a circular hole in the center and glue it to the slip. The section is then arranged within the circular space, the mounting-medium is added and the cover adjusted to fit the paper. When well done, such an arrangement is as good as anything ever devised, the advantage being that very thin cells of known thickness can thus be procured. As, however, the method is rather tedious when compared with later devices, the use of the paper cell has now become nearly obsolete. The materials now employed for cell building are the cements mentioned in the last lesson, and, for their better application, an instrument—the turntable—has been invented. This instrument consists of a circular, horizontal, revolving disc, at one side of which is a platform for a hand-rest, the plane of which is slightly above and parallel with that of the disc. On the center of the disc are a number of concentric circles corresponding with the diameters of the various round cover-glasses, and which act as a guide to the brush when applying the cement. Clips are also provided for holding the slip. The choice of a turntable is not of very great importance, as they are all based on the same idea, and are all about equally servicable. In the Griffith's self-centering

turntable with detachable hand-rests, the slip can be quickly centered on the disc—a matter of some importance—and the detachable hand-rest, which allows a higher elevation of the hand when operating, will be found very convenient. An ordinary plain table can be purchased from any of the various dealers for from \$3 to \$4. The Griffith table is somewhat more expensive, costing \$7.50.

The art of cell-building is not difficult to learn, though much practice is required to attain perfection in it. The procedure can be described as follows: Place the turntable somewhat obliquely, with the revolving disc away from the person and looking towards the left, if right-handed. Center the slip on the disc and hold it there with the clips or other appliances provided for the purpose. Now set the disc in rapid motion. Dip a camel's hair brush in the cement to be applied, (zinc-white for instance), and resting the hand on the platform, touch the brush tip lightly to the slip over and somewhat outside of one of the circles marked on the disc. A ring of the cement will form instantly. After waiting a few minutes another ring can be laid on the first one, and this can be repeated until three or four light layers have been formed. The cell should then be laid to harden for a day, when it will be ready for use, or to be still further added to if necessary. Now for a few details. The brush should be one of medium size, with a good though not too delicate point. If the brush is too long or too soft it will drag; if too short or too hard it will scratch. Be careful in judging of the amount of cement taken. If too much is used it will spread beyond the desired limit, if too little the surface of the ring will be uneven. Of course these points can only be gained by experience. The manner in which the brush comes in contact with the slip is of considerable importance. The brush-tip should be applied so that when it touches the slip the revolutions of the disc will tend to pull the hairs straight away from the handle. This point will be found at the spot where a line drawn at right angle with the short axis of the plane of the platform would meet the circle as a tangent. This line gives the position of the brush. With these hints the beginner must learn for himself. The whole operation is so simple in its idea that once being told what to do it will not require much ingenuity to make out how to do it.

EDITORIAL.

IN glancing over one of our exchanges we came across the following sentence in a review of the proceedings of the American Society of Microscopists for 1886: "There can be no doubt that this Society is doing a good work, and while it is the means of publishing much that is crude and which might better be left in manuscript, it still serves as a center for many who otherwise would not belong to any scientific association."

We presume this means that in spite of its fault in publishing some crude matter, the Society can be commended for drawing to it a class not easily reached. The tone of the above extract is one that is becoming altogether too prevalent in scientific circles of this country, and for that reason we have thought well to notice it.

Admitting, as we do, that some of the published matter may seem crude, yet, before condemning, it certainly were better to find, if possible, the cause of this crudity, and then to decide if, after all, its publication is so undesirable. Can it not be accepted as a fact that much of this crude work is done by the "many who otherwise would not belong?" and is it better that they should write not at all than to write that which, in the minds of those apparently more fortunate, may seem crude?

The purposes of a scientific society, especially ones like the A. S. M., or A. A. A. S., in which the work done is of a very general character, should be two-fold: (1) The advancement of science and (2) its diffusion, and it is a question in our mind if, after a certain point, the latter purpose should not take precedence over the former. The diffusion of science by societies cannot, we think, be better accomplished than by encouraging all who are anxious to learn to become members, and when this is done, encouraging them to work, even though that work be somewhat crude. In the majority of cases, where work is persisted in, this crudity will disappear, and the ultimate result will be that the army recruited through the diffusion of science will be the larger to work for its advancement.

There should be no place for an aristocracy in science. We need more men like Tyndall, Huxley and Youmans, and we need more societies in which the requirements for membership are not too stringent—too selfish, and in which all members are urged to do *some* work.

Societies, the work of which is general in character, have been organized in which the membership is limited either by number or

by conditions which make it impossible for many to qualify, the given reasons for such organization being that a large membership, and the presence of those not thoroughly trained in the subjects under discussion, tend to hamper good work. We notice, however, that the advancement of science brought about by many such societies causes no particular alarm, and as for the diffusion of knowledge the results are practically *nil*.

The American Society of Microscopists was organized on a broad and liberal basis. Members are urged to do some sort of work—manual if not mental. The result has been that knowledge obtained through use of the microscope has been not only advanced but given an impetus in this country which will, and does, result in much good. We do not think, however, that the benefits of its work in the future could be furthered by an over-fastidious regard as to what may be read at its meetings or published in its transactions. What ill results may happen from such a course will certainly be more than balanced by the good.

A wiser selection of officers for the coming year could not have been made by the A. S. M. Prof. Kellicott has served the Society faithfully for many years, and contributed to its transactions numerous papers which are of great interest and value. Prof. Burrill is just the Secretary needed, and his past official position has given him the advantage of knowing and being known by every member, while his contributed paper would honor any scientific body. Dr. Mosgrove, too, has served the Society well as Assistant Treasurer, and is, therefore, most admirably fitted for the advanced position of trust in which the Society has placed him. We venture to hope that, good as the last meeting of the A. S. M. was, and valuable as were the papers presented, the coming meeting may be still better, and the scientific work done be far in advance of any yet accomplished by the Society.

TECHNOLOGY.

METHOD OF STAINING AND FIXING THE ELEMENTS OF BLOOD.

Recent discoveries of morphological elements in the blood hitherto unknown, as well as the newly published facts concerning its coagulation, have aroused an interest in the subject which calls for an acquaintance with the methods with which it is possible to

follow those results. Accordingly, I would like to describe the method employed in this laboratory (Zurich); for, although it has been mentioned by Professor Gaule in his lectures for several years, it has not as yet been published.

The methods formerly used were that of examining fresh blood and that, perfected by Ehrlich, which consisted in staining dried blood.

Our method consists in a series of manipulations requiring only thirty-five minutes for their completion.

The following is a list of the reagents, together with the length of time and the order in which each is to be used:

	Min.
1. Corrosive sublimate (concentrated solution).....	6
2. Distilled water.....	1
3. Absolute alcohol.....	5
4. Distilled water.....	1
5. Hæmatoxylin ($\frac{1}{2}$ per cent. alum solution to which, for every 100 c.cm. employed, 20 drops 5 per cent. alcoholic solution have been added).....	6
6. Distilled water.....	1
7. Nigrosin ($\frac{1}{2}$ per cent. water solution).....	1
8. Distilled water.....	$\frac{1}{2}$
9. Eosin (1 gr. eosin dissolved in 60 c.cm. alcohol; 140 c.cm. distilled water).....	2
10. Alcohol.....	5
11. Oil of cloves.....	1-2
12. Xylol.	
13. Canada balsam (diluted with xylol until it flows readily).	

As receptacles for these fluids, each person has upon his table three shallow glass dishes with flat bottoms, so large that a slide may be easily put in and taken out of them. Into the first of these we pour corrosive sublimate, into the second distilled water, and into the third absolute alcohol. It is necessary either to label the dishes or to place the two not at the moment in use at one side. For the coloring-fluids we use bottles whose stoppers serve at the same time as droppers or pipettes. The most convenient form has a glass stopper, which is hollow and drawn out into a fine point below, while above it broadens into a funnel with a lip whose opening is closed by a rubber membrane. A slight pressure upon the membrane causes, upon the removal of the finger, a rise of fluid in the funnel, which, upon the removal of the stopper from the bottle, can be at pleasure

dropped upon the slide. For oil of cloves, xylol, and Canada balsam wide-mouthed bottles are used. In the first two bottles are brushes; in the last, the ordinary glass rod. Other necessary utensils are a glass rod, sharp-pointed scissors, clean slips and cover-glasses, filter-paper, twine or coarse thread, a small bottle of absolute alcohol, a sharp, clean needle, a fine, clean rag, and a hand-towel.

Aside from these, a board, fifteen by five inches, with two pair of holes, large enough for a piece of tape to pass through double, is an essential help. The first pair of holes should be four inches distant from the second, and the two holes of each pair one and a half inches apart. The tape should be so passed through the holes that there will remain upon one side of the board, loops, on the other, long ends, by which, upon passing the extremities of the frog through the loops, one may easily and firmly tie the frog upon the board. Such preparation is necessary, otherwise the manipulations cannot follow one another quickly enough. After these preliminaries have been completed, the labelled bottles being placed within reaching distance, the distilled-water and alcohol in front of these, and the corrosive sublimate nearest of all, we are ready to bind our frog upon the above-mentioned board and begin our preparation. We make use of the frog for this purpose at first, since its blood coagulates less quickly than that of mammals. The vena femoralis, which may be seen as a dark blue line below the knee-joint on the inner side of the leg, having been snipped, we quickly bring with a glass rod a drop of the blood which comes from the wound upon a slip previously moistened by the breath, and throw the whole into the dish of sublimate for six minutes. If a little care is taken to spread out the drop of blood in putting it on the slide, the result is more satisfactory. Brought from the sublimate into the dish of water, we find that the greater part of the blood adheres to the slip. The superfluous sublimate being washed from the preparation during the moment that it remains in the water, we next partially dry the slip by resting it upon filter-paper before dropping it into the alcohol bath. The slip which has remained in alcohol six minutes, is brought again into distilled water for half a minute, since our coloring fluids are water solutions. The hæmatoxylin is then dropped upon the slide, and removed again at the end of six minutes by resting the edge of the slip upon filter-paper, and afterwards washing with distilled-water for one minute. The same process follows with the nigrosin and eosin, the first remaining upon the slip for one minute, the second two minutes. From the eosin

we bring the preparation directly into alcohol, since the eosin is partially an alcohol solution. At the end of five minutes the slip is taken out of the alcohol, and, in order to be quite sure that there is no water still clinging to the preparation, we incline the slip at a slight angle to the rag with which we are holding it, and pour a few drops of alcohol from the small bottle over it. If upon dropping oil of cloves on the preparation it should be dark upon a dark sleeve or other dark background, we may remove the oil of cloves with a few drops of xylol. Having quickly cleaned the slip close up to the preparation, we place a drop of Canada balsam upon it, which must be allowed to spread out before the cover-slip is lowered upon it.

Human blood is prepared in the same way, except that here the finger-tip undergoes the surgical operation. If a finger of the left hand be lightly bound with a string and a sharp needle be held in the right a quarter of an inch from the end, one quick energetic stroke suffices to bring a drop of blood to the surface, which should be transferred to the slip by drawing it, previously moistened, across the drop of blood.

A look at our preparations with the microscope shows us that the coloring substances we have used have attached themselves to certain parts and certain forms of corpuscles. In the preparation of the frog's blood we find that the large oval red corpuscles have been colored red with eosin. The nuclei are for the most part blue from hæmatoxylin, the well-known coloring substance for nuclei. The protoplasma, provided no coagulation has occurred, is homogeneous. The usually oval nuclei are also generally homogeneous, though occasionally granulated like the nuclei of other cells.

The white blood-corpuscles differ among themselves in form, color, and the number and size of their nuclei. 1. Those coarsely granulated which are deeply colored with eosin, hence their name "eosinophilous cells,"* are perhaps the most striking. Their form, is usually round, and they contain from one to four nuclei. 2. A second is perhaps best characterized by its large nucleus sparsely surrounded with protoplasma, colored blue with nigrosin. The form of the cell, according to the position in which we see it, is spindle-shaped, with an oval nucleus in which the granules are distinct, and seem to be arranged in lines parallel to the long axis of the nucleus, or it is quite round with a round nucleus. The name "hæmatoblasts" was given them by Hayem. 3. Another variety has, like the "eosino-

*This name is given by Ehrlich.

philous cells," several nuclei. Its protoplasma is, however, blue like that of the "hæmatoblasts," its form irregular, recalling the forms that the amoeba is wont to assume; accordingly such cells have been called "amoebocytes." 4. Occasionally one sees still another cell, whose single large nucleus is oval or irregular in outline and lies in protoplasma like that of the "amoebocyte." These cells are larger than the other white blood-corpuscles, and contain here and there foreign bodies, such as pigment-granules and drops of fat in their protoplasma. They are called on account of their form "endotheloid cells." With further study of the preparation other forms are found, which may be looked upon as intermediate between "hæmatoblasts" and "amoebocytes," for in some cases the corpuscles have nuclei like "hæmatoblasts," whereas the protoplasm has increased in amount and sent out projections like the pseudopodia of an amoeba; in others the nucleus is round instead of oval; in others still the nucleus seems to be in the act of falling into two parts.—*Am. Naturalist*.

(To be continued next month.)

MIXTURE FOR WRITING ON GLASS.—Barium sulphate 3 parts, ammonium fluoride 1 part, and sulphuric acid sufficient for decomposing the ammonium fluoride and making the mixture of a semi-fluid consistency. This should be prepared in a leaden dish, and is preferably kept in a gutta-percha or lead bottle, although a glass bottle coated inside with paraffin, beeswax or rubber will do. A common pen is used in writing.—*Am. Druggist*.

COLE'S METHOD OF PREPARING EPITHELIUM.—A frog is taken and its small intestines, in pieces, placed in a five per cent. solution of ammonium chromate. The head also with the nostrils slit up is also placed in the same agent. After forty-eight hours the specimens are washed in an abundance of water, and then placed in picro-carmin for a few hours. The contents of the intestine are then scraped out; the nasal septum is scraped, as also the roof of the mouth, and the scrapings mounted in Farrant's medium. A portion of the three scrapings may be mounted under separate covers on the same slip, thus showing *squamous* epithelium (from the mouth), *columnner* epithelium (from the intestines), and *ciliated* epithelium (from the fauces).

PREPARING THE EPIDERMAL TISSUES OF PITCHER PLANTS.—Dr. J. M. Macfarlane states (Rep. 55th Meeting [1885] Brit. Assoc. Adv. Sci., 1886) that the difficulty he experienced in getting clean and large

pieces of the epidermis from the different surfaces of pitchers induced him to try various methods of preparation. Maceration in caustic potash solution of 2 per cent. strength gave admirable results. The pitchers to be macerated were placed whole in beakers containing the solution, and boiled over a Bunsen flame for from 10 minutes to 2 hours. The pitchers of *Nepenthes*, if young and fresh, had both outer and inner epidermis loosened from the green cellular and fibrovascular systems after about 15 or 20 minutes boiling; old or dried pitchers require 30 to 60 minutes. By floating them afterwards in clean water, both epidermal layers could be detached with great ease. Pitchers of *Cephalotus* were macerated after 10 to 20 minutes' treatment; but those of *Sarracenia*, *Heliamphora* and *Darlingtonia*, except when young and tender, required boiling for about 2 hours, with subsequent maceration for 2 or 3 weeks in water.

In this way not only could long pieces be obtained for continuous microscopic examination of the surfaces, but bottled hand specimens of the entire inner epidermis of *Nepenthes* could be made, showing clearly to the naked eye the attractive conducting and secreting surfaces, with associated glands.

Similar treatment of leaves for preparations of hairs, water and air stomata, etc., give equally good results in many cases.—*Jr. R. M. Society.*

RESILVERING MIRRORS.—The *Scientific American* gives the following method for resilvering mirrors: Clean the bare portion of the glass by rubbing it gently with fine cotton, taking care to remove any trace of dust or grease. If this cleaning be not done very carefully, defects will appear around the place repaired. With the point of a knife cut upon the back of another looking-glass around a portion of the silvering of the required form, but a little larger. Upon it place a small drop of mercury; a drop the size of a pin's head will be sufficient for a surface equal to the size of the nail. The mercury spreads immediately, penetrates the amalgum to where it was cut off with the knife, and the required piece may now be lifted and removed to the place to be repaired. This is the most difficult part of the operation. Then press lightly the renewed portion with cotton; it hardens almost immediately, and the glass presents the same appearance as a new one.

NOTES FROM AMERICAN POSTAL MICROSCOPICAL CLUB NOTE BOOKS.—A. P. Brown recommends the following modification of Farrant's solution for starches: Gum arabic, selected, about 2 oz.;

glycerin, ammonia, of each, $1\frac{1}{2}$ oz.; mix. It requires about two weeks for the gum to dissolve. It should be shaken occasionally and finally strained through fine muslin without pressure. This medium hardens at the edges of the cover in a few hours, when the latter may be cleaned and sealed with any desired cement. C. M. Vorce recommends the use of a bright steel knitting-needle for stirring the above mixture, or Farrant's solution, as fewer air bubbles are formed.

ABSTRACTS.

LOUIS PASTEUR.

The *Popular Science News* publishes the following excellent sketch of Pasteur, whose reseaches on the prevention of hydrophobia by inoculation have rendered him famous all over the world.



Although he is most widely known in connection with this method, his discoveries in other directions have been of much more practical importance than the inoculation with the modified virus of rabies, the actual value of which is still uncertain. True, hydrophobia is such a rare disease, and presents so many varying aspects, that a long time must necessarily elapse before any plan of treatment can be said to be absolutely specific.

A committee, comprising some of the most distinguished English scientists and physicians, has recently published a report strongly affirming the efficacy of his method of preventing the development of this terrible disease.

This indorsement from a tribunal so capable of judging of its value, and, at the same time, so unprejudiced and impartial, cannot but be most gratifying to M. Pasteur, as well as reassuring to the general public, who may be in danger from the attacks of rabid animals.

One of his earliest investigations was upon a disease among silk-worms, which threatened to destroy the silk industry in France. He succeeded in bringing it under control, thus saving immense sums to the silk-growers of that country. His system of inoculations for the prevention of anthrax in cattle, has also proved a most efficient means of protection against that fatal disease; and a process of preserving and improving wine and beer, by destroying the microbes by artificial heating, is extensively used in Europe under the name of "Pasteurization." The various species of microbes, bacteria and ferments seem to be a favorite subject of study with M. Pasteur; and the importance which these organisms possess, both from a medical and technological point of view, render them a fitting subject for the researches of the highest scientific talent.

We trust that M. Pasteur may be long spared to continue his work, which, we have no doubt, will be of even more value to mankind in the future than in the past.

BACTERIUM OF TEXAS FEVER.—Dr. Frank S. Billings, director of the Patho-Biological Laboratory of the Nebraska State University, has discovered a bacterium, which he considers the germ of Texas fever. He has found this germ in the blood, gall, urine, liver, spleen and kidneys of affected animals, and by pure cultures, inoculations, etc., has demonstrated it to be the cause of this dread cattle plague. In a communication to the *American Lancet*, he says: "It cannot be distinguished from the H. C. germ under the microscope, or in its growth on agar-agar, but differentiates itself very sharply by its growth on potatoes, having a delicate straw color, while the other germ has a muddy coffee color."

NEWS AND NOTES.

DR. W. W. BAILEY advises the use of Le Page's glue in mounting plants for the herbarium.

GUSTAV ROBERT KIRSHOOF, an eminent natural scientist and discoverer of the spectroscope, is dead.

THE death of Dr. George Winter, editor of *Hedwigia*, is announced as having occurred August 16.

THE *Swiss Cross* for October contains an admirable portrait and sketch of the late Spencer Fullerton Baird.

PROF. VERNEUIL has been elected member of the Academie de Science, Paris. He succeeds the late Prof. Gosselin.

A. C. WIGHTMAN and H. V. Wilson are to fill the fellowships in biology at John Hopkin's University for the coming year.

THE Journal of the New York Microscopical Society is now published quarterly instead of in nine numbers yearly, as formerly.

J. H. WYTH, the author of *The Microscopist*, a compendium of microscopical science, read a valuable paper on "The Physiology of Elementary Fibres" before the International Medical Congress.

DR. W. P. MANTON has been appointed associate editor of the Annual of the Universal Medical Sciences, with the subject histology and microscopical technology as applied to medicine, assigned to him.

GRANT ALLEN, the well-known English scientific writer was born on one of the Thousand Islands, and was taught the first rudiments of higher education beneath the shadow of the elms at Yale College, New Haven.

THE microscopical changes in Cirrhosis of the Pancreas have been found by Dr. Earle to consist of an increase of the connective tissue, and a partial, in some cases a complete, crowding out of the glandular elements.

DR. CARL BUNSEN publishes in the August 20th *Scientific American Supplement* a valuable and exhaustive paper on "Microscopical Researches into the cause, origin and propagation of Diphtheria." The article is illustrated by nine drawings.

THE enterprising publishers of THE MICROSCOPE, and the *Pharmaceutical Era*, offer a prize of fifty dollars in gold for the best essay on The Mutual Relation of Physician and Pharmacist. A neat circular letter, stating conditions, etc., is sent to all interested.

A. J. HOWE, M. D., says too much attention is given to bacteriology and not enough to unorganized poison, the virus of decomposition. There may be microbes on a palatable beef-steak or mutton-chop, and the food be none the worse for it, and yet a very savory dish of meat may be poisonous.—*Technics*.

Mr. F. W. Leggett, in his paper before the New York Microscopical Society, concluded that the reason that the roach is able to walk when inverted and suspended on the under surface of a horizontal plate of glass, lies in the fact that the tarsal joints are cap-shaped, and of peculiar construction, and that the insect attaches its feet by suction.

JAMES STOLLER contributes to the October *Swiss Cross* an interesting article on "An Aquarium Study." This may consist of an ordinary fruit jar filled with water dipped from a weedy pond, and containing a few living water-plants, of which *chara* and duckweed do well. Many interesting forms of aquatic life may be thus studied, both with the naked eye and under the microscope.

OLIVER WENDELL HOLMES, in an address to the Harvard Medical School, referred to the achromatic microscope as having "created a new era in medical science," to say nothing of its great services in other departments of knowledge. He illustrated the power of the instrument strikingly by saying, 'while a scrap of human skin was under the glass, that the fragment thus magnified represented an individual just one mile in height. He would ten times overtop the loftiest of the pyramids, and twenty times the tallest of our steeples. His breadth and thickness being in proportion to his height, his weight would be one hundred and twenty billion pounds, equal to sixty million tons. "He could take our State House up as we would lift a paving-stone," the Doctor added, "and fling it into the waters beyond Boston lighthouse, cleaning out that place of the people by a summary process quicker than the prætorian bands of Domitian or Commodus would have cleaned out a Roman Senate chamber that dared to have an opinion of its own."

BOOK REVIEWS.

MICROSCOPY. Reprints from *Am. Naturalist*; Dr. C. O. Whitman.

PLANT CHEMISTRY, as Illustrated in the Production of Sugar from Sorghum, by Helen De S. Abbott; reprint.

DIET IN CANCER. I. Full Text in Nine Cases. II. Theoretical Considerations; by Ephraim Cutter, A.M., M.D., L.L.D.; reprint.

MANUAL OF CLINICAL DIAGNOSIS, by Dr. Otto Seifert and Dr. Friedrich Müller. Third edition. Translated by William Buckingham, Canfield, Am. M. D. (Berlin). New York: G. P. Putnam's Sons, 1887.

In this manual the authors have given in an epitomized form the different methods of examination, as well as a convenient collection of those data and figures which should always be familiar to the physician and student.

The material collected is difficult to remember, and is scattered about in many works. Many of the articles are very short and unsatisfactory, but answer well for the purpose in view. The chapters on foods and the dose table are particularly well selected, and make the little book one which should be on the table of every physician, and in the pocket of every student. The translator has given a very smoothly-reading rendition of the text. We note several typographical errors, one of the worst of which is giving $\frac{1}{2500}$ in as the equivalent of the micro-millimeter.

MICROSCOPIC BOTANY A manual of the Microscope in Vegetable Histology, by Dr. Edward Strasburger; from the German by Rev. A. B. Hervey. Boston: Samuel E. Cassino, 1887, pp. 382.

We are glad to welcome Dr. Strasburger's "Kleine Botanische Practicum" in its English dress. This work is already so well known to students of botany, who read German, that we need only refer to its merits by saying to others that no botanist who desires to be thoroughly grounded in this subject can afford to be without it, while every microscopist who is interested in vegetable histology, will find it the best hand-book to aid them in their work. The use of the microscope, making of permanent preparations, methods of study, and the various cell-elements which go to make up the plant are clearly discussed and illustrated in the thirty-two lessons into which the work is divided. In an appendix are placed the most reliable stains and reagents, which will be found valuable, especially to the beginner. Mr. Hervey has given an excellent translation, and wisely omitted much verbiage with which the German original is filled, and which, to the English reader at least, is irrelevant and unessential.

The book is gotten up in the publishers well-known elegant and substantial style.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be INSERTED FREE OF CHARGE. The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.

MOUNTS OF SALICINE, PURE UREA, AND OTHER CRYSTALS, by an entirely new process, and the most beautiful ever seen, in exchange for strictly first-class pathological slides only, or for sale. FRANK L. JAMES, M.D., Box 563, St. Louis, Mo.

WANTED—A microscopical slide cabinet containing about one thousand objects. Must be in good condition. Send description, price, etc., to JAMES B. SHEARER, Bay City, Mich.

GOOD histological or pathological mounts for other first-class mounts. S. G. SHANKS, M. D., 547 Clinton Ave., Albany, N. Y.

FOR SALE—Beck Popular Binocular with complete outfit, 2-in., 1-in. and $\frac{1}{4}$ ob. polariscope, parabola, double nose-piece, 3 sets eye-pieces, etc., in perfect order, only tarnished. Price, \$80. Address WM. H. SEAMAN, Patent Office, Washington, D. C.

WANTED—B. eye-piece (to fit Bausch & Lomb's smaller stands), a camera lucida, a stage micrometer (metric preferred) and a good turn-table; also Carpenter, or Beale, on the Microscope. Will exchange for above, books on Mineralogy and Chemistry and general literary works. Correspondence solicited. A. F. BARNARD, Box 152, Oberlin, O.

EXCHANGE.—I have well mounted slides of diatoms, also diatomaceous material which I offer for curiosities or materials suitable for a cabinet. F. L. CAUCH, Carpentry, Santa Barbara Co., Cal.

LABELS for slides; also, slides and material. EUGENE PINCKNEY, Dixon, Ill.

EXCHANGE.—Will exchange slides of vegetable sections, double-stained, for other good slides, preferably of the same nature. CHAS. E. BARR, 301 Clinton St., Cleveland, O.

WANTED—Standard books on Rotifera, Infusoria, Diatoms, Algæ, etc. Will exchange general and scientific works for the above. JAMES E. WHITNEY, Rochester, N. Y.

FOR EXCHANGE—Diatomaceous earth from Los Angeles, for good mounts. M. H. ALTER, M. D., 41 South Spring St., Los Angeles, Cal.

FOR EXCHANGE OR SALE—Double-stained Bacillus Tuberculosis slides. Will exchange for histological or pathological mounts. F. T. MERIWETHER, M. D., Asheville, North Carolina.

FOR EXCHANGE.—I have for exchange for mounted slides specimens of crystallized quartz, microscopic and small, perfect crystals, crystals from one-half to three inches in diameter, crystals containing floating particles, crystals containing cavities, and some containing hornblende. State which you prefer, and I will endeavor to give satisfaction. D. M. FULLER, 154 Hamilton St., Albany, N. Y.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,

At 32, 34 and 36 Seitz Block, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to "THE MICROSCOPE," 25 Washington Ave., Detroit, Mich.

Subscriptions, Advertisements and all business matters are attended to by the publishers, D. O. HAYNES & COMPANY, P. O. Box 583, Detroit, Mich.

No receipt will be sent for subscriptions received unless specially requested.

Specimens for examination should be sent to the *Microscope Laboratory*, 25 Washington Avenue, Detroit, Mich. In all cases the transportation charges on these specimens must be prepaid, and special directions for packing and shipping will gladly be sent upon application.

VOL. VII.

DETROIT, DECEMBER, 1887.

No. 12

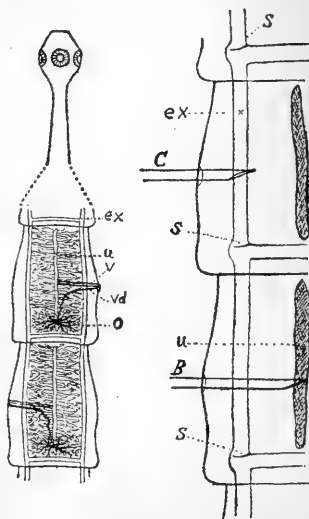
ORIGINAL COMMUNICATIONS.

THE TAPE-WORM. METHODS OF PREPARATION FOR THE MUSEUM AND THE MICROSCOPE.*

BY J. M. STEDMAN.

HOPING that it may be of benefit to others, I venture to give some methods by means of which I was enabled to preserve a tape-worm (*Tænia Saginata Gæyi-mediocanellata*, Kuch) and at the same time show its anatomy most beautifully.

For museum purposes the excretory (water-vascular) system (*ex*) of the whole worm, or the latter part of it, in which the uteri are fully developed, is injected with a fine injecting mass, such as used for the fine injection of cold-blooded vertebrates. This can be readily accomplished by inserting the end of a canula (*c*), which should be cut off obliquely, into the generative cloaca, or opening of the vagina (*v*), in which operation the excretory canal (*ex*), will be cut, and if the canula be not inserted too far, the whole of the excretory system caudal of the canula will be injected without any difficulty.



* Transactions of the American Society of Microscopists, 1887.

This operation of injecting will demonstrate the presence of valves (*s*) in the canals at the caudal part of each proglottid or segment of the worm.

Thus it is that only that portion of the excretory system caudal of the insertion of the canula will be injected, the valves (*s*) preventing the flow cephalad. The worm, after being injected, is then washed in water and put into a 75 per cent. glycerine, to which has been added a few drops of acetic acid. In the course of a few hours the worm will become transparent, and in addition to the excretory system, the uteri (*u*), the ovaries (*o*), vagina (*v*), and vas deferens (*v d*), which change but little if at all, will be distinctly seen. If a worm or a portion of it thus treated be suspended in a bottle of 75 per cent. glycerine so as to be easily seen, and the bottle thoroughly corked, the specimen will keep indefinitely. A tape-worm thus prepared is, indeed, a beautiful as well as instructive object.

For microscopical purposes, about five centimetres of the worm treated the same as for the museum was mounted in glycerine jelly in a cell in the usual way. Another portion had the uteri (*u*), and ovaries (*o*) of several of the segments also injected. The operation of injecting the uteri and ovaries is very simple, and is readily accomplished by forcing the canula (*b*) further in than in the case of injecting the excretory system, so that the canula reaches nearly the center of the segment. Occasionally the uteri can be injected by forcing the canula but a little way into the vagina (*v*).

Segments in which the uteri are fully developed and extended with ova, need not be injected, as they are quite distinct; but the ovaries and the miniature uteri are not seen well unless injected. A few centimetres of the worm in which the excretory system is injected with one color and the uteri with another, form very beautiful preparations.

Another preparation for the microscope was made by placing a few segments of the worm in Müller's fluid for three days, after which it was injected, both the excretory system and the uteri (for unless the uteri are injected they will not be seen in this preparation), then hardened in 50, 75, 95 per cent. alcohol, cleared in turpentine 3 parts, carbolie acid 2 parts, and mounted in balsam. These preparations in balsam require more work than those in glycerine, but it may pay in the future, and the greater permanence compensates for the extra labor.

Mature segments of the worm were hardened in Erlick's fluid and alcohol, and cut into transverse and longitudinal sections. The longitudinal sections show the valves (s) of the excretory system in their natural position.

The nervous system may also be studied by means of sections.

Ova were taken from the last segment, placed in picric acid and alcohol (50 per cent. alcohol, 100 cc. picric acid, 1.5 grammes) for 30 minutes, and mounted in balsam.

The only published methods of which I am acquainted for the preparation of the tape-worm, will be found in "Manual de Microscopie Clinique," par G. Bizzozero, et Ch. Ferret, in which will be found a process which consists of drying.

CORNELL UNIVERSITY.

ON INDEXING MICROSCOPICAL SLIDES.*

R. H. WARD.

THE Alphabetical Index is, of course, a large and essential portion of this system. Its pages are specially ruled for convenience in entering titles and numbers, and they have a capacity for several references to each slide, the volume for 2,000 slides having room for about 10,000 references. Thus a leaf preparation may not unlikely be referred to under both popular and scientific names of the plant, and also under several such titles as, "Leaf of —," "Spiral vessels in —," "Stomates of —," "Raphides in —," etc. But as many simple slides require only two or three entries, the more complex ones will have room for eight or ten. The Index is lettered alphabetically, the number of pages assigned to each letter depending upon the frequency with which that letter occurs at the beginning of English words. Subdivision is accomplished according to the vowel system of arrangement, whose advantages are familiar to all readers, and which may, by means of a few obvious expedients, be made applicable to slide-catalogues of various sizes. Thus the pages devoted to any letter, as S, are divided into six portions and lettered SA, SE, SI, SO, SU, SY; the first portion being for words beginning with S, and having A for their first vowel, and so on for the rest. Further subdivision depends so largely upon individual wants as to be best left optional with the user. But having given a page to the SA words, for instance, it is hardly possible that any thoughtful person could throw all these

*From a paper on "A Slide-Catalogue," read at the Pittsburg meeting of the Am. Soc. Mic.

together at random. Probably nearly every one would enter things pertaining to animals at the top of the page, vegetables in the middle and minerals at the bottom, or *vice versa*. A specialist in any department would give the lion's share of the page to his particular province, subdivided to suit himself; and the vegetable kingdom, being in the middle, could be carried up or down, where experience shows that room could best be spared. After such entries as starch, pollen, hair, etc., several lines would be left blank for similar items, so that ultimately these items would appear in blocks that would be instantly recognized on glancing at the page. In larger collections, where SA included many pages, a certain number of these whole pages would be assigned to animal, vegetable and mineral objects respectively. In this case a botanist, for instance, would probably reserve more pages for plants than for all the rest, and at first he might devote a column, or even a whole page to such a group as starches, and a like portion of SE to seeds, one column of the seed page being given to whole seeds, and another to sections, etc. Subsequently, if too much space proved to have been reserved anywhere, the lower portion of the vacant parts would be filled with other things. By such expedients a rough but most useful working classification of the pages and their contents can be maintained until the book is nearly full. The accompanying sample page of SA entries of familiar objects, though much more crowded, and therefore less satisfactory, than in actual use, shows how such a plan is carried out, and with what facility any object may be found in a collection of three or four thousand slides.

Obviously the catch-word by which an entry will be found is its first word, by which it was located and sought for; and the other most characteristic word, which distinguishes the item from others of its kind, and which may or may not be the only other word, may be underlined for easy recognition. The writer uses pencils of different colors for this purpose, in the serial list as well as in the Index, red for animal, green for vegetable, and blue for mineral specimens, and thus gains a perspicuity whose value is evident. By a little extra care in labeling the slides, the same distinction of color may be extended to the labels, using red, green and blue tinted papers, or white paper with printed borders of those colors, as a means for rapidly recognizing and distributing the slides themselves whenever they have become mixed in use.

SA.	ANIMAL.	NO.	VEGETABLE.	NO.
Saw-Fish, tooth sec.....		233	Scales (see Hairs).	
Scaly Epithelium.....		272	“ of Fern.....	207
Scale Insect.....		2440-3		
		2364		
			“Star Polishing Powder”...	2526
Scales (see Wings).			Starch, Corn.....	886
“ of Mosquito.....	273		“ Potato, and <i>in situ</i> ..	887-8
“ Lepisma.....	2066		“ Canna, pure and	
“ Podura.....	2797		commercial.....	955-6
“ Cabbage-Butterfly..	2106		“ Wheat.....	980
“ Tinea.....	2699		“ Rice, pure and	
			adulterated.....	1125-6
			“ Arrowroot, <i>in situ</i> ..	1699
“ Sole, and <i>in situ</i> ...	665-6		Sanguinaria, sec.....	710
“ Trout.....	1596		“Star Fungus”.....	730
“ Flounder, & <i>in situ</i>	1597-8		Salicine.....	1536
“ Gold-Fish.....	1599			855
“ Eel.....	1863		Santonine.....	1029
“ Sturgeon, sec.....	2096		Stamens (see Flowers).	
“ Dog-Shark.....	2098		“ Lobelia.....	1367
			“ Salvia.....	1368
			“ Tradescantia.....	1710
			“ Vaccinium.....	1839
			“ Deutzia.....	1982
Starfish (young).....	2005		“ (Petaloid).....	2880
“ Madroporic body.....	2006			2173
“ Pedicellaria.....	2007		“ Willow (to ovaries)	2740-4
“ Spine secs.....	2527-9			
	2030-7			
			Scalariform Vessels... ..	2930
Sarcina.....	1495			2885
Sarcoptes.....	1925-6		“Santa Monica” Deposit....	2891
Scalp, secs.....	2025-6			
“ Negro.....	2131			
Statoblasts of Cristatella....	2508			
			MINERAL.	
Sarcoma, Giant-cell.....	573		Satin Spar.....	589
“ Spindle-cell.....	1496		Sand, Oolitic.....	987
“ Cystic.....	1731		“ Auriferous.....	2820
“ Osteo.....	1792		“ Sonorous.....	2907
“ Round-Cell.....	2804			
“ Melanotic.....	2987		Stalactite.....	2831
	2820			1983
Snails, “Palates”.....	1073-8		Slag from Iron Furnace....	2256
			“ “ Copper “	2741

Though not admitting the absolutely alphabetical sequence attained by cards, this system is in some respects even more practical than that for small collections, say up to three or four thousand slides. It is easier to see and compare numerous items when collated upon a page than when stacked away in cards. Thus fifty or sixty entries of hairs or of crystals can be reviewed and compared, and a half-dozen selected for some purpose, much better by glancing over a page than by leafing over that number of separate cards; while the graphic effect of the page is of perceptible use in keeping one's mind constantly familiar with the extent and character of his collection. The cards are theoretically better, and in very large collections practically better for finding any specified slide that one knows he wants; but are not better, nor even as good, for assisting him to decide what he wants among many.

TROY, N. Y.

CRYSTALLINE FORMATIONS OF LARD AND OTHER FATS.

PLATE VII.

BY DR. THOMAS TAYLOR.

FIGURES 1 and 3. Respectively, primary and secondary crystals of loon fat. $\times 110$.

Figures 2 and 8. Primary and secondary crystals of musk-rat fat. The primary (No. 2) are always very small, measuring about three one-thousandths of an inch in diameter.

Figure 4. Crystals of oleo. $\times 140$ diameters. (Extract of beef-fat.)

Figure 5. Crystals of common lard by plain light. $\times 400$.

Figure 6. Secondary crystals of butter. $\times 110$.

Figure 7. Crystals of beef-fat. $\times 140$.

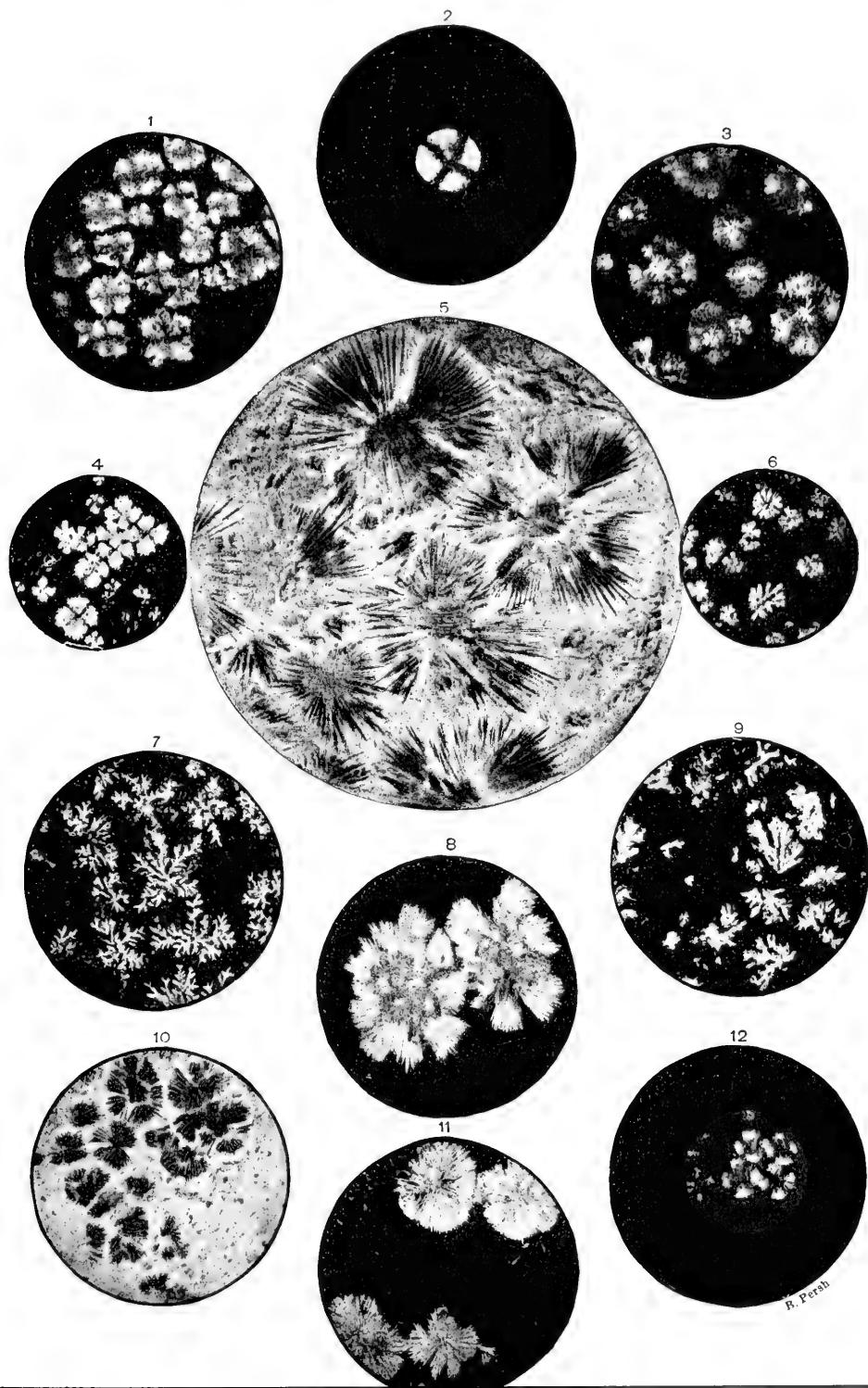
Figure 9. Crystals of deer-fat. $\times 140$.

Figure 10. Lard by plain light. $\times 140$.

Figure 11. Crystals of the solid fat of cotton-seed oil. $\times 110$.

Figure 12. Neutral lard crystals, miniature. $\times 140$.

U. S. AGRICULTURAL DEPARTMENT, WASHINGTON, D. C.



PROCEEDINGS OF SOCIETIES.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE regular semi-monthly meeting of this society was held September 28, 1887, Vice-President Dr. Ferrer in the chair.

Dr. Henry Ferrer exhibited a new rectilinear lens of wide aperture made by Steinheil of the old Fraunhofer Institute of Munich, especially for photographic purposes.

He also exhibited some work he had done with the lens, producing reduced copies of some fine large drawing of his own, made with India ink, and showing sections of the human eye.

To show the excellent work being done by members of the San Francisco Microscopical Society, Secretary Wickson read a letter which was recently received from Dr. Frank L. James, of St. Louis, editor of the *St. Louis Medical and Surgical Journal*, in which he made allusion to mountings of *bacillus anthracis in situ* in lung tissue, made by Dr. S. M. Mouser of San Francisco, stating it was his belief "that a better preparation never has been made"—that he did not rely solely upon his own judgment but cited the verdict of Dr. D. V. Dean of St. Louis, a thorough microscopist, who, after a long and careful examination, pronounced "the slide the best he had ever seen." This testimony is creditable to Dr. Mouser and to the San Francisco Society, and indicates that in scientific work, as in other efforts, California is making most gratifying progress.

By unanimous vote Dr. Henry Ferrer was elected President of the Society to fill the vacancy occasioned by the resignation of Mr. Wickson, who retired from the Presidency to take the chair of Recording Secretary.

EDWARD J. WICKSON, *Recording Secretary*.

BALTIMORE MICROSCOPICAL SOCIETY.

AT the first annual meeting of the Baltimore Microscopical Society, held October 17, 1887, the following officers were elected: President, Prof. G. L. Smith, A. M.; Vice-President, Lewis M. Eastman, M. D.; Secretary and Treasurer, Robt. T. Wilson, M. D.; Librarian, A. H. Ehrman. President G. L. Smith in the chair.

The President welcomed the members after such a long vacation and encouraged them to renewed activity in the work. He thought

that a society composed of men from the different professions and from mercantile life, should be able to discuss papers and topics of special and general interest. He laid great stress upon the fact that the Society was formed not only for microscopical work, but for the study of the microscope itself, as an instrument, and he invited the members to discuss questions and read papers on the technique of microscopy, as well as upon other matters of interest to the society.

Dr. A. K. Bond spoke of the Phenylhydrazin test for sugar in the urine, as applied by Prof. Ultzmann, with special reference to the character of crystals formed. He remarked that the detection of sugar in the urine had for a long time been a subject of interest to practicing physicians. The amount of sugar which might be present in the urine of a patient might vary from a few grains to several ounces a day. Sometimes a patient's attention was first arrested by the crystallization of sugar in drops of urine which had fallen on his or her clothing. For the detection of sugar many tests had been used. There was the Polariscopic method, in which the plane of polarization of a ray of light passed through a specimen of urine was turned toward the right if grape-sugar was present. The difficulty with this test was that it was not delicate enough and was liable to errors. Next he mentioned the Fermentation test, in which yeast was added to the urine in an inverted glass vessel and if sugar were present fermentation took place and the resulting gas was collected and tested. This method, he thought, was not very delicate. Next came the group of reduction tests in which metallic salts were added to the suspected urine, and, if sugar were present, became reduced by the sugar to the metallic state or to salts of a different color. Some of these tests were extremely sensitive and very useful. In certain cases, however, a considerable amount of the test-fluid might be reduced by saccharine elements in the urine. A very interesting case had come to his notice in which the reduction by the urine of a gentleman who applied for life insurance was so great that a number of companies refused to insure him, yet further examination by others and by himself showed that no sugar was present. These facts, he thought, showed the need of some new test, not belonging to any of the classes above named. Such a test he here presented. It depended upon the formation of very characteristic crystals containing the sugar itself. Sugar might be obtained from urine in several forms of colorless crystals, as by direct crystallization of the pure sugar, or by the treatment with sodium chloride; but these methods were of little practical value.

In 1884 a method was discovered by Emil Fischer of Erlangen, by which crystals of peculiar form and yellow color could be obtained in urine containing sugar. These crystals consisted of Phenylglucozone, a substance formed by the union of Phenylhydrazin and grape-sugar. At the clinic of Prof. Ultzmann in Vienna, he had seen a reliable test used, a modification of this method much simpler than any yet published. Dr. Bond had obtained some of the phenyl salt and on his return tested carefully the value of this method. He thought the result ranked with the best of the reduction tests, and in some respects, indeed, perhaps in all respects, excelled in usefulness all tests heretofore known. The crystals which he showed under the microscope were yellow needles seen readily by a low power, and possessing a peculiar tendency to group themselves into sheaf-like forms. He exhibited also some crystals formed from milk-sugar, by this same method, which were somewhat similar in form and color to those from grape-sugar, but grouped themselves differently. In the

DISCUSSION

which followed, Dr. Bond replied to questions asked by Drs. Eastman, E. M. Schaeffer, Culbreth, Wilson, Canfield and the President, by saying that if sugar were present in large amount the yellow crystals could be seen as a yellow deposit, with the unaided eye, but in cases where only a small quantity of sugar was present the urine was allowed to stand, and the crystals were drawn up by a pipette and examined microscopically. He also stated that in his experience the test failed to show the trace of grape-sugar said to be physiologically present in all urine by V. Brücke and Bence Jones.

Dr. Wm. B. Canfield exhibited a specimen of *Argyria* with the following history: A patient in the Vienna General Hospital had been taking for a long time the nitrate of silver for locomotor ataxia. He subsequently died and at the post-mortem a section of the kidney was made by him and stained with haematoxylin and rosin. The tubules and interstitial structure appeared normal, but the glomeruli were black, which was probably due to the deposit of metallic silver or oxide of silver in the bloodvessels. He also exhibited a specimen of cystin crystals which were obtained from a patient of Dr. Christopher Johnson's. The crystals had been made by dissolving the sediment in ammonia and allowing it to crystallize in a water-bath. They were interesting as being remarkably well formed and also on account of the rarity of cystinuria.

Mr. Thos. D. Coleman (Johns Hopkins University), exhibited a new microscope by Leitz of Wetzlar, which he had just received from Germany. The general opinion of all present was that it was a very fine instrument.

Prof. P. R. Uhler (Peabody Institute), spoke of the importance of using the microscope, from a geological stand-point. He thought that if insects and microscopical life which is thrown with the soil were examined, much light would be thrown upon the character of the region.

Dr. Lewis M. Eastman referred to a diatom slide prepared by Sir John Kinker of Amsterdam, and recently sent to him by that scientist. It represents in an arranged manner, one of each variety of diatom found in the Monterey Earth. He thought that such slides coming from such a distinguished worker, were of great value to the scientist, and of marvelous beauty to all.

ROBT. T. WILSON, M. D., *Secretary*.

MICROSCOPICAL SOCIETY OF PITTSBURG.

AT the annual meeting of this Society, held on October 25, 1887, C. C. Mellor was re-elected unanimously to his third term as President. G. H. Clapp, of the firm of Hunt & Clapp, metallurgists and chemists, was made First Vice-President, and W. B. Jackman, of the chair of Natural History in the High School, Second Vice-President. Dr. H. Dupuy and James H. Logan were chosen Secretaries, and Dr. Gale French, Treasurer. The report of President Mellor for the year just completed showed the Society to be in a prosperous condition, with seventy-eight active members. A large book-case has just been put in their room, together with a couple of hundred works of microscopical literature. Considerable other material has also been ordered, including microscope-stands, mounting-apparatus, and a number of English books on microscopy.

The programme outlined by Mr. Mellor in his address looks forward to original researches by the members, who were counseled to pursue special lines of investigation, and he expressed the hope that at some period in the near future the scientific societies of Pittsburg might be gathered together in an Academy of Science, with suitable rooms and apparatus for the most advanced work. Donations of slides for the Society's collection were reported from

Miss M. A. Booth, THE MICROSCOPE, and Mr. C. G. Milnor. Among objects exhibited were statoblasts of *cratatella*, from the Ohio River; *batrachospermum moniliforme*; and a number of objects mounted in Berry's hard finish, as described by Dr. Seaman, of Washington, at the August meeting of the American Society.

OHIO STATE MICROSCOPICAL SOCIETY.

SEVERAL gentlemen of Columbus and other cities, interested in science, met in the rooms of the State Board of Agriculture Thursday evening, October 27, and organized what is to be known as the "State Microscopical Society," by the selection of the following officers: President, Dr. H. J. Detmers; Vice-President, Dr. N. S. Townshend; Secretary, Dr. O. Frankenberg; Treasurer, General John Beatty; Trustees, Professors Weber and Tuttle and Dr. A. M. Bleile. Drs. Detmers, Bleile and Frankenberg, who were appointed at a previous meeting to draft a constitution and by-laws, reported in favor of rules similar to those governing the Illinois Society. It was decided to hold the meetings on the last Friday of each month, the annual meeting to be in October. Applicants for membership must be recommended by two or more members of the Society, and the admission fee will be not less than one dollar nor more than three dollars, at the discretion of the Trustees, and the annual dues not to exceed two dollars.

The new Society has several rooms in view, but a lecture-room in Starling Medical College seems to be one of the most desirable, and it was decided to hold the next meeting at that place. There are at present about forty members, which is considered a very fair beginning.

THE ST. LOUIS CLUB OF MICROSCOPISTS.

THIS Club held a regular monthly meeting at the College of Pharmacy on Tuesday evening, Nov. 8. A majority of the members were present and took an active part in the work of the evening. J. C. Falk exhibited some unusual pathological specimens. Prof. H. M. Whelpley showed some of the different methods of determining whether an object is an air bubble or an oil globule. A. P. Erker was elected an active and Professor F. Hemm an honorary member. Several applications for membership were deferred to the next meeting.

Messrs. A. C. Speth and J. C. Falk will entertain the Club with specimens and short talks at the next meeting, which occurs Tuesday evening, December 6.

THE LOUISVILLE MICROSCOPICAL CLUB.

THE Louisville Microscopical Club was organized on Thursday, October 6, with the following members: Rev. C. J. K. Jones, President; Dr. Julia A. Ingram, Vice-President; Mr. Simon Flexner, Secretary and Treasurer; and Dr. F. C. Leher, Dr. H. A. Cottell and Professor E. Mark. The objects of the "Club" are set forth in the first article of its Constitution, which is as follows:

"This organization shall be called the 'Louisville Microscopical Club.' Its objects shall be the promotion of friendship and congeniality among its members, and the encouragement of microscopical research."

CENTRAL NEW YORK MICROSCOPICAL CLUB.

AT the meeting of this Club, held October 31, at the rooms of Dr. R. Aberdein, Professor J. F. Boynton addressed the members on "Microbes with Reference to Disease." The discussion of the address was taken up by Drs. Didama, Mercer, Maxson and the Rev. D. W. Smith, the President.

THE Microscopical Club of the Buffalo Society of Natural Sciences have arranged a very instructive and entertaining programme for the coming season. This includes some fifteen original papers by well-known microscopists, and a number of practical demonstrations for instruction, etc. We trust that other societies will emulate the example.

The officers for 1887-88 are: George E. Fell, M. D., President; Miss Ada M. Kenyon, Corresponding Secretary; Lewis A. Bull, M. D., Recording Secretary and Treasurer; and D. S. Kellicott, Ph. D., George W. Jenis, M. D., and Henry Mills as Advisory Council.

ELEMENTARY DEPARTMENT.

TENTH LESSON.

“CLEANLINESS IS AKIN TO GODLINESS.”

MOUNTING IN A CELL. Before entering on a description of this process, it is well to again call attention to a fact in this connection, which, if not observed, may ultimately lead to the destruction of the mount. And that is that the material of which the cell is composed should be perfectly insoluble in the mounting-medium employed. Patent as this may seem, it is too often forgotten by the beginner, and even when the ill results are noticed, and the cause explained, runs the danger of again being forgotten. With glycerin as a medium, one has little care on this score; but with the solvents generally employed with the gums and balsams, the case is different. Of the cell-materials mentioned, all are more or less affected by chloroform or benzol, whilst glycerin can be used with perfect safety. For balsam and gum-dammar mounts, special cements for building cells have been proposed. The writer, however, has never found these necessary. The cements given in the last lesson are, in his opinion, undoubtedly the best, and he has contrived to use them with any mounting-medium. The object is attained by simply coating the cell with some substance insoluble in the medium. With glycerin, as said, this need not be done; with balsam or dammar (when dissolved in chloroform or benzol) it is only necessary to coat the cell with a film of mucilage of acacia to prevent any undesirable action of these solvents. This is very easily accomplished. A little mucilage of the right consistency is obtained, and with it, by means of a camel's-hair pencil, the inner and top portions of the cell are painted. If the operator is expert the turntable will be found convenient to do this, otherwise, it should carefully be done by hand. The mucilage should be laid on an hour or two before the cell is to be used, thus allowing it to dry. If put on several days before, it is liable to crack, and thus diminish its usefulness.

The process of mounting in a cell does not differ essentially from the method already described where no cell is employed. A drop of the mounting-medium is placed in the centre of the cell-space, the specimen is then lowered into the drop by means of a needle (the specimen-carriers cannot be used here) and carefully

arranged, and the cover-glass is then placed exactly as heretofore described. Much depends on a correct estimate of the quantity of mounting-medium required. In mounting without a cell this is not of so much importance, for if too much is used it can be squeezed out and cleaned off. But with a cell, although the squeezing process is simple, the cleaning off is much more difficult. Especially is this true as regards balsam. To clean off the outer wall of a cell streaked with exuded balsam is no easy matter. It is better, however, to use too much rather than too little, for, in the latter case, it will usually be found necessary to remove the cover and supply the deficiency. Care should be taken also to avoid the inclusion of bubbles. If bubbles form in a glycerin or dammar mount, no time need be wasted in an attempt to get them out. It is better to do the mount over again. With balsam, especially when quite thin, a few bubbles at the top will probably work out, but if the medium be thick the bubbles may remain suspended in the depth, and not work to the surface until the edge has hardened. The avoidance of the bubbles depends on the care with which the cover is lowered. (If bubbles are present before the cover is lowered, they should be removed by piercing them with a hot needle). In the second lesson, page 108, will be found full instructions for doing this. It is only necessary to substitute the top of the cell for the slip.

SEALING. — After the cover-glass has been properly set, it should be held in place by means of a spring-clip. If a balsam mount, the slide should be laid away to harden; if glycerin has been employed it should be cleaned at once and cemented. The cleaning should be done with water, applied with a camel's hair brush, or as a stream from a wash-bottle. Great care must be taken that the water does not get under the cover. After a thorough washing, it should be dried and inspected to see if any water or glycerin linger on the surface. If all is dry, it is ready for the seal. With balsam mounts it is only necessary to wait until the exuded medium has hardened when it can be scraped away. Do not attempt to cleanse it with turpentine as it may eat under the cover. All being ready, the clip is to be removed and the slide centered on the turn-table. With the disc rapidly revolving, a *light* ring is applied by means of a soft camel's hair brush to the juncture of the cover and cell. If a glycerin mount, the beginner will probably have trouble, as the cover-glass, through the pressure of the brush, is liable to slide away from its position. If, however, the pressure is very light, and the force applied from the right direction (which must be learned by experi-

ence) the difficulty may be obviated. The light ring being finished, see again that no glycerin has escaped, and then lay away to harden. The cover-glass will now be found firmly fixed, and as many layers of cement as necessary may be added. It is well to put on several of these layers, a sufficient number to at least hide the edge of the cover.

The choice of cements can depend on the individual taste. The glycerin cannot affect them, and the balsam is rendered innocuous through hardening. If the reader has never seen a cell-mount, it is advisable to procure one as a pattern before undertaking their manufacture. Much patience and practice will be required to attain perfection in the art.

The follower of these lessons is now able to perform the more simple operations required in the preparation of microscopical objects. The purpose of these papers has, therefore, been accomplished, and they will be discontinued. The writer is perfectly well aware of their imperfections, but feels that these will, to a great extent, be atoned for by the gentlemen who take up the thread of this department with the coming year. He is informed by the editors that Dr. W. P. Manton will contribute a series of papers on the elementary microscopical technique of embryology, and that Dr. Frank W. Brown will take up a course in histology, in which, of necessity, there will be much of technique new to this department.

FINIS.

EDITORIAL.

SPECIAL NOTICE.

WITH this issue of THE MICROSCOPE the special business arrangement between Messrs. D. O. Haynes & Co. and the editors and proprietors is, by mutual consent, dissolved.

During the year past our publishers have done all in their power to advance the interests of this journal and have been liberal in both time, money and personal energy, so that to-day THE MICROSCOPE stands at the head of this class of publications, and circulates in every state and territory in the United States and largely in Canada, as well as in many foreign countries. While we regret that the pleasant relations which have existed between the editors and D. O. Haynes & Co., publishers, are thus brought to a

close, the ever increasing business of the latter enterprising firm renders it inexpedient for them to longer continue as the business management of this journal.

We desire on this occasion to express our thanks and appreciation for their efforts in behalf of THE MICROSCOPE, and to wish them success in their future business career.

While the change in business management throws some additional labor on the editorial staff, it will not in the least affect the interests of THE MICROSCOPE, which for the coming year will be better in every respect than ever before. A glance through the index which accompanies this number, will convince the reader that never was there so much valuable information relative to microscopy crowded into 384 pages. During the year we have published more than 53 original articles, 50 abstracts, 14 editorials, 38 notes on technology, besides innumerable news items, and reviewed over 50 books and pamphlets of interest to the general microscopist; while the pages of THE MICROSCOPE have been illustrated by 37 cuts and 7 full page plates. We have hitherto refrained from speaking of ourselves, but the eminent success met with by THE MICROSCOPE during the past year, and the hundreds of complimentary letters received from all parts of the country, cause us to look back upon 1887 with pardonable pride and satisfaction.

The past of this journal is a guarantee of its future success. If there is any doubt of this, an examination of the prospects for 1888 will convince the most sceptical. Never in the history of any publication devoted to microscopical science has a finer array of talent been displayed than may be found in the list of names of contributors and coöperators for 1888.

Our premium list will be a surprise. THE MICROSCOPE is worth more than the money asked for it, but in order to increase its circulation still further we are offering the slides to all who may desire them. Having been prepared in THE MICROSCOPE LABORATORY in large quantities, it must not be expected that they will all have the same exquisite finish as those advertised by specialists; but they are all good, and many of them very fine and not to be excelled.

In the January number of THE MICROSCOPE we shall publish a fine portrait and a sketch of Prof. D. S. Kellicott, President of the American Society of Microscopists. This portrait will be sent only to subscribers for 1888.

CORRECTION: The word in heavy type, QUANTITATIVE, at the foot of the page of the pink premium list, should read QUALITATIVE. Please make a note of this.

SPENCER F. BAIRD.—A bright star in the scientific firmament disappeared when Spencer F. Baird, on the 19th of August last, passed from the activities of his earthly life. He was a man of gentle manner, modest and unobtrusive in all his ways, but honored with the respect and affection of all his fellows and collaborators in the work of exploration among the natural sciences. His great labors and his greater triumphs will secure for him a high place in the gallery of American scientists. He was born in Reading, Pa., on the 3d of February, 1823, graduated at Dickinson College, in Carlisle, Pa., in 1840, studied medicine in the College of Physicians and Surgeons, in New York, received a degree from the Philadelphia Medical College, became professor of natural history and chemistry in Dickinson College, his *alma mater*, became assistant secretary in the Smithsonian Institute in 1850, and its principal executive officer in May, 1878, on the death of Joseph Henry, its former Secretary and official head. He gave himself at once to the work of enlarging and enriching this great national institute, devoting much of his time, especially during the decade 1850–1860, to enlisting all officers at the head of governmental exploration in the objects of the Institute. He prepared the numerous specimens brought back by them to Washington from time to time, and these, with his own collection and those of the celebrated Wilkes exploring expedition, formed the beginning of the great National Museum, now the finest in the country.

From early youth his tastes led him to the field, the wood, the mountain-side, the lake and the stream; and it is said of him that his pedestrian expeditions sometimes covered over 2,000 miles in the course of the year. These tastes grew into a passion with him, and like the great Agassiz, his highest pleasure was found in the world of fishes, birds, mollusks, and the silent fields of extinct life. He was advisory counsel at the Halifax Fishery Commission, held

in 1877, and his work in this department has received universal recognition. The literary work accomplished by him in connection with his scientific studies was simply enormous. Up to January 1, 1882, no less than 1,063 titles were accredited to him, and in addition to these were his translation and editing of the famous Iconographic Encyclopedia in 1852, 4 vols., besides two large ones of accompanying engravings; "Catalogue of North American Reptiles"; "Mammals of North America"; "The Birds of North America"; "The Distribution and Migration of North American Birds," 5 vols.; and yet others, whose names and titles we do not recall.

For forty years he gave his life to the Smithsonian Institute, and it may be there said of him, as of Sir Christopher Wren, in St. Paul's: "If any one inquires after his monument, let him only look around him." We might add much more to this article pertaining to the life, habits and social qualities of this remarkable friend and devotee of the natural sciences, but want of space forbids. We can only say: "Well done, thou faithful laborer. We accept with gratitude the rich fruitage of thy toil, while we utter over thy premature grave a reluctant farewell."

ACKNOWLEDGMENTS.—From Dr. Thomas Taylor, Washington, D. C., slides of fat from human kidney; Prof. W. S. Jackman, Pittsburg, Pa., slide of tape worm; Prof. Whelpley, St. Louis, Mo., for courtesies; H. J. Detmers, excellent photograph of *A. pellucida*, taken by lamp-light with a Spencer $\frac{1}{16}$ in. hom. lense, Beck's No. 2 eye-piece, Bullock's professional stand. In the second photograph Tolles' $\frac{1}{15}$ in. hom. lense, with the same eye-piece as in the first, exposure twenty and twenty-five minutes respectively. We give these details for the reason that these photographs were made with American lenses, and are as fine as any we have ever seen. Van Heuck's well-known plates have no mean rival in these photographs by Dr. Detmers; we have received from Mr. Jas. B. Shearer of Bay City, Mich., a large number of mounted photomicrographs. In a former number we expressed our admiration of his work, which is fully confirmed by these latest arrivals. The mounting-card is a new feature, which, as one of our correspondents puts it, needs to be seen to be appreciated.

TECHNOLOGY.

METHOD OF STAINING AND FIXING THE ELEMENTS OF BLOOD.

(Continued from page 345.)

These latter forms suggest the idea that a relation may exist between "amœbocytes" and "hæmatoblasts," but what the relation may be, whether the change is from "amœbocyte" to "hæmatoblast" or the opposite, whether the "eosinophilous cells" and "endotheloid cells" are in any way related to them and to one another, cannot be determined by the method just described. Two courses lie open to us in our attempt to answer these questions: 1, to examine the same blood at intervals after it has been taken from the frog; or, 2, to watch changes in fresh blood which has been protected from evaporation. To do the first, we have simply to place a slide with a drop of blood upon it in a moist chamber,* and after certain intervals (five minutes, fifteen minutes, half an hour, two hours) to fix and color the blood as above. If we examine a preparation fixed at the end of two hours, the whole aspect is changed. We find representatives of the different forms, but not in the same proportion. The "endotheloid cells" have become more numerous and the other forms less so. The former have also become much larger, with broad hyaline borders. The granules of the protoplasma are coarser about the nucleus, but constantly smaller and less distinct towards the hyaline border. Between the protoplasma-granules are frequently pigment-crystals, and bodies colored with eosin. These foreign bodies lie often in clear oval spaces next to the nucleus; otherwise these spaces are empty, or contain a small nucleus, a clump of yellow pigment, or a body closely resembling a small red blood-corpusele. To control this experiment we may make use of another one,—that is, we may cover a fresh drop of blood with a cover-slip and seal it from the air.† Thus the blood coagulates slowly, and we may study directly the changes the forms undergo during coagulation. The granules of the "eosinophilous cells" may be seen to become larger, less distinct, and disappear. The "eosinophilous cell" has developed into the "amœbocyte." The "hæmatoblasts"

* The moist chamber is easily constructed by covering the bottom of a flat-bottomed dish with wet filter-paper and placing a ground-edged cover upon the dish, whose edges should also be ground.

† The edges of the cover-slip must be thoroughly free from moisture, a bit of melted wax dropped upon every corner, and the wax then drawn along the edges of the cover-slip with a heated iron wire.

assume the forms mentioned above, the nucleus and cell as a whole become round, and at length send out pseudopodia in every direction, so that it is impossible to distinguish them from "amoebocytes." The "amoebocytes," in their turn, at first stretch out their pseudopodia in a lively manner, then gradually attach themselves to the cover-slip, where they spread themselves over a large surface, and resemble the "endotheloid cells" with their broad borders of hyaline substance and the granulated protoplasma about the nucleus. If we now bring together the facts we have observed,—1, in instantly fixed blood; 2, in blood fixed after intervals; 3, in fresh blood,—we find that the first three kinds of white blood-corpuscles may at length become "endotheloid cells."

What is, then, the fate of the "endotheloid cells?" Are the bodies we have described as lying in their protoplasma and resembling incomplete blood-corpuscles to be considered as such? The endothelial cells which they resemble are, as is known, broad, flat cells, that lie spread out on the inner surface of the blood-vessels similarly as the "endotheloid cells" flatten themselves out on the cover-slip. Their protoplasma is colored with nigrosin, and in the small capillaries, where one or two cells suffice to form the circumference of the capillary, has been observed to contain pigment and more or less developed red blood-corpuscles. Especially is this the case in the liver and spleen of the frog. If the spleen be teased out, and its cells fixed and colored in the manner mentioned above, not only do we find that the number of white blood-corpuscles, especially of the "endotheloid cells," is much larger in proportion to the red blood-corpuscles than it is in circulating blood, but other cells are present which possess the general characteristics of "endotheloid cells" and endothelial cells. They are richer in pigment, contain often several undeveloped red corpuscles, and cling together in groups. Gaule, in his Strassburg lecture, called these cells "Ammenzellen," because in them he observed the development of the red blood-corpuscles. In the course of his observations of a series of frogs he noticed that the "Ammenzellen" which lie in groups similar to the follicles of the animal spleen, between the arteries entering and the veins leaving the spleen on the periphery, undergo significant changes, normally, in the course of the winter, under the influence of pilocarpine, in a few hours. The result in both cases was the same. The "Ammenzellen," at first rich in pigment, lose their pigment as the number of undeveloped corpuscles increases. At the same time the number of corpuscles in the circulating blood

was counted, the result showing that as the pigment of the "Ammenzellen" decreased, the number of the circulating red corpuscles became greater, the quantity of undeveloped corpuscles increased, and that many of the circulating corpuscles were still bordered with granules of pigment. Another indication that blood-building elements are present in the "Ammenzellen" was the iron reaction which the protoplasm gave with potassium ferrocyanide. From these observations it seems hardly to be doubted that red blood-corpuscles are developed in the "Ammenzellen," and partially at least in the endothelial cells, and in the "endotheloid cells." The relation in which these three cells stand to the blood-vessels remains to be considered. The blood-vessels of the embryo have their origin, as the embryologists have taught us, in the mesoderm in chains of endothelial cells which contain clear spaces in their protoplasm that later communicate with one another to form a fine capillary, in whose wall the first red blood-corpuscles are formed. Returning to the spleen, we recall the fact that the "Ammenzellen" groups lie between the capillaries of the arteries, with their endothelial cells on the one hand and the capillaries of the veins on the other hand, and that between the in-flowing and out-flowing vessels the regular blood-vessels with their lining cells fail. It is, then, not difficult to suppose that the "Ammenzellen" and the "endotheloid cells," which are so numerous in the spleen, might be the stage upon which, as in the mesoderm of the embryo, a constant building of new blood-vessels and blood-corpuscles is taking place. The white blood-corpuscles of the frog may perhaps be looked upon as undeveloped "Ammenzellen," though their origin and the functions peculiar to each form are not yet clear. It is significant that a seeming relation exists between the coagulation of the blood and the formation of white blood-corpuscles, for as the blood of the frog begins to coagulate the "hæmatoblasts" become especially numerous, and group themselves characteristically; but to this point we shall refer again in connection with human blood, which is in many points similar to the blood of the frog.

The red blood-corpuscles of human blood contain, as is known, no nuclei. In our preparation they retain the disk form and color, like the protoplasm of the red corpuscles of the frog with eosin. The white blood-corpuscles are represented by the two forms "eosinophilous cells" and amœbocytes." The "hæmatoblasts," as such, are wanting in human blood, but since we have had our attention directed by Hayem to the fact that the "hæmatoblasts" play an important part in the coagulation of the frog's blood, it is possible

to think that some element is present in mammalian blood which also acts as a factor in coagulation. The coagulation of the frog's blood begins with the grouping of the "haematoblasts" into a rosette form. The red corpuscles then arrange themselves radially about this point as a centre. Do we find an analogous process at the commencement of the coagulation of mammalian blood? The blood of mammals coagulates very rapidly, whereas that of the frog changes very slowly; hence, if we would study the blood of mammals before coagulation, we must prevent this process by means of some reagent. Such an experiment cannot be tried with a human being, but is easily made with a dog. The reagent usually employed is peptone, which is injected in solution into the jugular vein of the dog, the amount injected being 0.3 grain peptone for every kilogramme weight of the dog. The microscopical examination of blood in which coagulation has thus been prevented, shows that there exist in the blood, aside from the other elements, tiny tablet-like granules which tend to cling together in clumps. These elements were described by Bizozzer, and called by him "Blutplättchen." It thus seems probable that the "Blutplättchen" have something to do with the coagulation of the blood. That they also exist in human blood is evident from their presence in our preparation as small, faintly-tinted bodies, which lie in groups of twos and threes together. They did not disappear from the blood we employed, because we did not give it time to coagulate before fixing it. Therein lies the advantage of this method in the examination of human blood. It gives us not only the possibility to distinguish the different elements of the blood, but through it, it has been possible to discover elements which, like the "haematoblasts," accompany the phenomenon of coagulation, and also to determine in part the relation that exists between the elements. It would not agree with the general plan of nature if every form did not play a different rôle in the organism, and after all that has been discovered it is not improbable that we shall one day be able, through watching the changes which the different elements undergo in the blood, to discover the disturbances caused by different ferments and organisms in the blood. Thus we think that the hope of clever physicians may one day be verified, that the analysis of a drop of blood may give a clue to the pathological changes in the body.—*Am. Naturalist.*

PREPARING EGGS OF ROTATORIA.—In the *Zeitschrift f. Wis. Zoologie*, Dr. Tessin gives an account of his difficulty in obtaining good preparations of the small eggs of Rotatoria. His process with

Brachionus is to rapidly kill the eggs by immersing in chrom-acetic acid; this gives rise to little or no distortion. The eggs are then placed in weak alcohol, and later transferred to strong. The writer states that picro-sulphuric acid produces great distortion, and corrosive sublimate does not penetrate. Hæmatoxylin is the stain to be used; carmine is useless. Clarify in creosote. Paraffin penetrates with difficulty.

HEIDENHAIN'S STAINING METHOD.—Prof. R. Heidenhain finds that the following slight modification of his well-known staining method yields the most beautiful results. Tissues hardened in alcohol, or better in a saturated solution of picric acid first, and then in alcohol, are left for twelve to twenty-four hours in an aqueous solution of hæmatoxylin ($\frac{1}{3}$ per cent.), and then placed for twelve to twenty-four hours in $\frac{1}{2}$ per cent. solution of *simple yellow chromate of potassium* (instead of the red double chromate). The usual dehydration with alcohol, penetration with xylol, and imbedding in paraffin, follow.—*Jr. R. M. Soc.*

ABSTRACTS.

THE THERMAL DEATH-POINT OF PATHOGENIC ORGANISMS.

Dr. Geo. M. Sternberg has completed the series of experiments to which we referred in an editorial in the July number of *THE MICROSCOPE*, and has published his observations in the *American Journal of the Medical Sciences* for July, 1887.

All of the experiments recorded relate to moist-heat,—that is to say, the test-organisms have, in every case, been in a moist condition, in fluid cultures. The effect of dry heat upon desiccated organisms is quite another question.

This has been studied by Koch and Wolffhugel, who have summarized the results of their experimental work as follows:

(1). A temperature of 100° C. (212° F.) maintained for one hour and a half, will destroy bacteria which do not contain spores.

(2). Spores of mould-fungi require for their destruction in hot air a temperature of from 110°—115° C. (230—239° F.) maintained for one hour and a half.

(3). *Bacillus* spores require for their destruction in hot air a temperature of 140° C. (284° F.) maintained for three hours.

In his experiments, Dr. Sternberg adopted ten minutes as the standard time of exposure to a given degree of temperature. A fresh culture of the organisms to be tested is introduced into capillary glass tubes, which have an expanded extremity to serve as an air-chamber, by means of which the culture-fluid is drawn into or forced out of the capillary tube.

This is readily accomplished by heating the little bulb. The glass tubes, hermetically sealed, are introduced into a vessel containing water, which is kept at a uniform temperature by personal supervision, a Bunsen burner being the source of heat. A standard thermometer is placed in the vessel, and this and the capillary tubes are protected from the bottom of the vessel containing them by a thick plate of glass.

A uniform temperature throughout the fluid is maintained by stirring it with a glass rod. After exposure for ten minutes to a given temperature, the sealed extremity of the capillary tube is broken off with sterilized forceps, and the contents are forced, by heating the air in the expanded extremity, into a test-tube containing sterile flesh-peptone-gelatine, which has been liquefied by exposure in a water bath to a temperature of 40° C. or below. The cotton plug is only removed for a moment in order to introduce the contents of the capillary tube, and in his extended experiments he has rarely seen any accidental contamination.

A rubber cap is next placed upon the open end of the test-tube and the gelatin is spread in a uniform manner over the interior of the tube by the method of Esmarch. This is accomplished by rolling the tube in iced-water until the gelatin hardens.

These tubes are then kept at a temperature a little below the melting point of gelatin—20° to 22° C.—for at least a week.

If the test-organism has not been killed by the temperature to which it was exposed, colonies are developed in the gelatin which may often be recognized by the naked eye within a day or two.

In other cases development is retarded, and it is only at the end of four or five days that evidence of growth is seen.

The absence of growth at the end of eight or ten days is taken as evidence that the vitality of the test-organism has been destroyed by the temperature to which it was exposed.

In every case a control experiment is made with material from the same culture which has not been subjected to heat.

In the following table Dr. Sternberg's studies are brought together with those of other observers. When not his own his authority is given in parenthesis. The time of exposure is ten minutes, unless otherwise stated.

Name of Organism.	Centigrade.	Fahrenheit.	
<i>Spirillum cholerae Asiaticæ</i>	52°	125.6°	4 m.
<i>Spirillum tyrogenum</i> ¹	52	125.6	4 m.
<i>Spirillum Finkler—Prior</i>	50	122	
<i>Bacillus anthracis</i> (Chauveau).....	54	129.2	
<i>Bacillus typhi abdominalis</i>	56	132.8	
<i>Bacillus mallei</i> ² (Löffler).....	55	131	
<i>Bacillus</i> of Schweine — Rothlauf (Rouget Pasteur)	58	136.4	
<i>Bacillus murissepticus</i>	58	136.4	
<i>Bacillus Neapolitanus</i> ³	62	143.6	
<i>Bacillus cavicola</i> ⁴	62	143.6	
<i>Bacillus pneumoniæ</i> ⁵	56	132.8	
<i>Bacillus crassus sputigenus</i>	54	129.2	
<i>Bacillus pyocyaneus</i>	56	132.8	
<i>Bacillus indicus</i>	58	136.4	
<i>Bacillus prodigiosus</i>	58	136.4	
<i>Bacillus cyanogenus</i>	54	129.2	
<i>Bacillus fluorescens</i> ⁶	54	129.2	
<i>Bacillus gallinasum</i> (Salmon) ⁷	56	132.5	
<i>Bacillus acidi Lactici</i> ⁸	56	132.8	
<i>Bacillus alvei</i> ; spores.....	100	212	4 m.
<i>Bacillus anthracis</i> ; spores.....	100	212	4 m.
<i>Bacillus butrycus</i> ; spores.....	100	212	4 m.
<i>Bacillus mycoides</i> ; spores.....	100	212	4 m.
<i>Bacillus tuberculosis</i> (Schill & Fischer).....	100	212	4 m.
<i>Staphylococcus pyogenes aureus</i>	58	136.4	
<i>Staphylococcus pyogenes citreus</i>	62	143.6	
<i>Staphylococcus pyogenes albus</i>	62	143.6	
<i>Streptococcus erysipelatus</i>	54	129.2	
<i>Micrococcus tetragenus</i>	58	136.4	
<i>Micrococcus Pasteuri</i>	52	125.6	
<i>Micrococcus gonorrhoea</i> ⁹	60	140	

1. Cheese spirillum.

2. Bacillus of glanders.

3. Emmerich's bacillus.

4. Brieger's Bacillus.

5. Friedlander's.

6. From water.

7. Pasteur's "microbe du cholera des poules."

8. Old culture in flesh-peptone-gelatine not killed by 60°, probably owing to the presence of spores.

9. A single experiment. A lower temperature would probably be effective.

Name of Organism.	Centigrade.	Fahrenheit.
<i>Sarcina Lutea</i>	64	147.2
<i>Sarcina aurantiaca</i>	62	143.6
Vaccine virus (Carstens and Coert)	54	129.2
Rinderpest virus (Semmer and Raupach)	55	131
Sheep-pox virus (Semmer and Raupach)	55	131
Hydrophobia virus	60	140

No attempt has been made to fix the thermal death-point within narrower limits than 2° C., and in the above table the lowest temperature is given which has been found in the experiments made, to destroy all of the organisms in the material subjected to the test. No doubt more extended experiments would result, in some instances, in a reduction of the temperature given as the thermal death-point for a degree or more.

But the results as stated are sufficiently accurate for all practical purposes, and permit us to draw some general conclusions:

(a.) The temperature required to destroy the vitality of pathogenic organisms varies for different organisms.

(b.) In the absence of spores, the limits of variation are about 10° centigrade (18° F.)

(c.) A temperature of 56° C. (132.8° F.) is fatal to the bacillus of anthrax, the bacillus of typhoid fever, the bacillus of glanders, the spirillum of Asiatic cholera, the erysipelas coccus, to the virus of vaccinia, of rinderpest, of sheep-pox, and probably of several other infectious diseases.

(d.) A temperature of 56° C. (132.8° F.) is fatal to all of the pathogenic and non-pathogenic organisms tested, in the absence of spores (with the single exception of *sarcina lutea*, which, in one experiment, grew after exposure to this temperature).

(e.) A temperature of 100° C. (212° F.) maintained for five minutes destroys the spores of all pathogenic organisms tested.

(f.) It is probable that some of the Bacilli which are destroyed by a temperature of 60° C. form endogenous spores which are also destroyed at this temperature.

BACTERIA IN EAR-FURUNCLES.—Lowenberg of Paris, has undertaken bacteriological researches, in a certain number of cases of still unopened boils of the meatus. In each case he first syringed this canal and then filled it for ten minutes with a luke-warm solution of bichloride of mercury ($\frac{1}{2000}$). A small portion of the pus was inocu-

lated with agar-agar, or nutrient gelatine, and plate cultivations were made of the whole. He obtained the following results: The micro-organism most frequently found was staphylococcus albus, which was absent in only one case; then came staphylococcus aureus, and staphylococcus citreus. Only in one case all these three staphylococci were traced together. These results differ from those obtained by N. Kirschner of Wurzburg, who only found staphylococcus albus.—*Peoria Med. Monthly*.

NEWS AND NOTES.

THE *American Naturalist* will again change its publishers in January.

THE *American Journal of Psychology*, Vol. I, No. I, has just appeared. It is published in Baltimore, with Dr. G. Stanley Hall as editor.

RICHARD C. GREENLEAF, who recently died in Boston, bequeathed his microscopical library, microscopes and apparatus to the Boston Society of Natural History.

CALCUTTA has a newly organized Microscopical Society, with Dr. Simpson, health officer of that city, as President, and the well-known zoologist, Mr. I. Wood-Mason, as Vice-President.

THE body of Audubon, the naturalist, now lying in an obscure corner of Trinity Cemetery, New York, is to be removed and placed opposite the Fifty-fifth street entrance, where a monument to his memory is to be erected by the Academy of Science.—*Weekly Med. Review*.

THE 36-inch telescope, the largest in the world, which was designed and built by Warner & Swasey, is finished and will be shipped to its destination, Mt. Hamilton, Cal., where it will be placed in the Lick Observatory. The total weight of the instrument is thirty-five tons.

BOOK REVIEWS.

A MANUAL OF MEDICAL JURISPRUDENCE, FOR THE USE OF STUDENTS AT LAW AND OF MEDICINE. By Marshall D. Ewell, M. D., LL. D., Professor of Common Law in Union College of Law, Chicago. pp. 409. Boston: Little, Brown & Company. 1887.

This little work, when compared with others on the subject, has the great merit of being concise, and free from much of the legal details which, to the medical man at least, are unnecessary, if not confusing.

In no other way has the physician been more humiliated than that brought about by his experiences in courts of law when called on in cases where his technical knowledge is sought. The inevitable question, "Why do you think so?" and the dissections of the physician's answers to that question should never lead to his discomfiture, for he should be prepared for just such an ordeal. The fault of all this lies not so much in his ignorance of the law as in that he does not know just what sort of facts will be required of him, nor how best to get them, even if he did know. In the book before us the physician will find all necessary data to enable him, in medico-legal cases, to leave the witness-stand with his self-respect intact; for Dr. Ewell has admirably succeeded in giving a concise resumé of the law, and then, more in detail, a clear idea of the line of evidence required. For the physician we can recommend this work as one of the best, and certainly the clearest, on the subject.

ANIMAL LIFE IN THE SEA AND ON THE LAND; A ZOOLOGY FOR YOUNG PEOPLE, by Sarah Cooper. Harper & Bros., New York, 1887. pp, 413. Detroit. John Macfarland.

"People grow better," says Daudet, "for listening to nature, and those who love her do not lose their interest in men." Certainly helps enough are afforded now-a-days, so that all, from the youngest to the oldest, may know something of nature, with little or no trouble on their part at finding out her hidden truths. We are glad to notice, however, that nearly all recent writers demand that the student shall study nature for himself, using the printed page only as a guide to keep him from falling into error. "It is far more charming to gain this knowledge from the objects themselves," says Miss Cooper in her preface, "than from merely reading about them in books." Taken as such a guide, Miss Cooper's book will fill—not perhaps a "long felt want,"—but an important place among these kind of books for the young. Beginning with the sponge—the various classes of invertebrates and vertebrates—the simplest forms of life to the most complex, are traced in gradual development. Each chapter is divided into sections, which bring out the characteristic points to be remembered; thus, for example, in the chapter on Crinoids are discussed: 1. Where crinoids grow. 2. Why they are called stone-lilies. 3. Crinoids compared to star-fishes. 4. Skeleton of circular plates. 4. Free-swimming crinoids. 6. An ancient family. 7. Fossil crinoids. 8. How fossils came to be in the rocks.

9. Records of our earth's history, etc., so that a careful reading, with the specimen in hand, will give the pupil a very clear and comprehensive knowledge of this interesting class. The writer evidently appreciates the importance of pictures to the young, for the work is profusely illustrated, and, although we recognize many old friends among the cuts,—278 of them,—their value is not lessened by repeated use. We feel sure that *Animal Life* will be a welcome addition, not only to the primary and common school library, but also to many a home where truth and knowledge have ascendancy over the raft of chip-dirt and fiction which flood the country with their demoralizing influence.

THE PHYSICIANS' LEISURE LIBRARY, 1887. Detroit, Mich: Geo. S. Davis. Single copies, 25 cents.

Two more numbers of this very handy and excellent series of modern books have been received. No. 3, "*Diarrhœa and Dysentery; Modern Views of Their Pathology and Treatment*," by A. B. Palmer, M. D., is an excellent and exhaustive essay on these common pathological conditions. The careful details of treatment make it a particular value to the practising physician.

No. 4, the second volume of "*The Modern Treatment of Diseases of the Heart*," by Desjardin-Beaumetz, treats of diseases of the aorta. The subject of aneurism is extensively considered, and the chapters on its treatment by electrolysis are of the greatest value. This mode of treatment demands the attention of all physicians who have to do with this grave disorder.

CANTOR LECTURES ON THE MICROSCOPE. By John Myall, Jun. London: 1886. Philadelphia: James W. Queen & Co. pp. 97.

These lectures, five in number, were delivered during the latter part of the year 1885, before the Society for the Encouragement of Arts, Manufactures and Commerce, and attracted considerable attention at the time. Mr. Myall is well known to microscopical science, and ably fitted for the work he had undertaken. The lectures comprise a history of the microscope from the earliest times to the present day, with many observations and criticisms by the writer. Here are figured many curious cuts of the grotesque and clumsy instruments of the 17th century; the ornate, though more useful ones of the 18th century; and finally, the compact triumphs of the present day. The text is clear, and shows the result of much research. Altogether these lectures can be recommended as probably the best compend of the history of this valuable instrument.

A POPULAR ZOÖLOGY, by J. Dorman Steele, Ph. D., and J. W. P. Jenks, A. M., Professor of Agricultural Zoölogy in Brown University. A. S. Barnes & Company, New York and Chicago. 1887. pp. 319.

Steele's well-known "Fourteen Weeks in Zoölogy," of which the present volume is an enlarged edition, was published in 1872, and immediately became the class-book in nearly every common-grade school in the country. Fifteen years, however, have seen so many changes in classification and nomenclature, that in order to bring the book up to the times, Professor Steele proposed a new edition, but although he was able to read the MS. of the Popular Zoölogy, his life ended before the work was given to the press.

Both this and the former edition of the book were written by Professor Jenks, whose life-long familiarity with the subject and well-known ability as a teacher, render his work both reliable and entertaining. In Popular Zoölogy, the student is not only put in possession of names and facts, but he is taught how to observe, collect, and, in a more than general way, how to make use of his knowledge. The work has been entirely re-written, is fully illustrated, and in binding, paper and type is all that could be desired. We predict its great popularity.

GRASSES AND FORAGE PLANTS; A PRACTICAL TREATISE COMPRISING THEIR NATURAL HISTORY; COMPARATIVE NUTRITIVE VALUE; METHODS OF CULTIVATION; CUTTING AND CURING; AND THE MANAGEMENT OF GRASSLANDS IN THE UNITED STATES AND BRITISH PROVINCES, by Charles T. Flint, late Secretary of Massachusetts State Board of Agriculture, etc., etc. Revised edition. Boston: Lee & Shepard. Detroit: John Macfarlane.

In glancing over the pages of this work one is impressed with the highly scientific tone of its contents, as well as their eminently practical nature. The chapters on sowing grass-seeds, time and mode of cutting grass for hay, curing hay, and the general treatment of grass lands, show the author to be a practical farmer as well as a scientific botanist. Although scientific farming is often made light of by those who may be termed "experienced farmers," and perhaps often brought into disrepute by the prodigal expenditures of the dilettante, still, we must look to it for the rapid advancement of remunerative agriculture. What scientific methods have done and are doing for other industrial pursuits, they will do for agriculture, and the sooner all farmers learn this the richer they will be. Mr. Flint's book is of the highest rank, and no agriculturist can afford to be without it.

SEXUAL IMPOTENCE IN THE MALE AND FEMALE, by Wm. A. Hammond, M. D. Detroit, Mich., 1887. Geo. S. Davis. Cloth, \$3.

This work is a vigorous treatise upon a very important subject by an able and experienced writer. We commend it to physicians.

JOURNAL OF MORPHOLOGY. Edited by C. O. Whitman, with the coöperation of Edward Phelps Allis, Jr. Milwaukee, Vol. 1, No. 1: Grim & Co. Boston, 1878.

The initial number of this long announced and expected journal has at last made its appearance, and a glance at its table of contents will immediately satisfy the most pessimistic as to its importance and value as an addition to current zoölogical literature. Heretofore the want of such a publication in the United States has forced writers on strictly technical subjects to find a medium for bringing out their writings in foreign countries—a condition which can now no longer obtain. The publication of this new journal marks an era in American zoölogy, for not since the contributions of the elder Agassiz has such a venture been undertaken. The time has come, however, when the zoölogists of this country—men who stand shoulder to shoulder with the *savants* of the old world—demand that their work be recognized at home, as it now is abroad, and that a journal for the dissemination of their work and views be sustained, not only by themselves as a class, but by all who are interested in true progress. There is a wide field of usefulness now unoccupied which such a journal may fill, and we predict the most kindly reception and liberal support of the publication under consideration.

The contents of the present number consists of seven papers on the following subjects: Sphyranura Osleri, a contribution to American Helminthology, by Prof. R. Ramsay Wright and A. B. Macallum; the development of the compound eyes of Crangon, by Dr. J. S. Kingsley; eyes of Molluscs and Anthropods, by Dr. William Patten; on the Phylogenetic arrangement of the Sauropsida, by Dr. G. Baur; a contribution to the history of the Germ-layers in Clepsine, by Dr. C. O. Whitman; the Germ-bands of Inubricus, by Prof. E. B. Wilson; studies on the eyes of Anthropods, by Dr. William Patten. The plates accompanying these articles are, with one exception, well executed lithographs, some of them colored.

We welcome *The Journal of Morphology*, and strongly urge that all who are interested in embryology, anatomy and histology will enroll themselves among its subscribers.

LINDSAY & BLAKISTON'S PHYSICIAN'S VISITING-LIST FOR 1888. P. Blakiston, Son & Co.: Phila.

This little classic (for it can now be called such, being in its thirty-seventh year of publication), is so well known that we need only say that its high character for convenience and compactness seems to grow with its increasing years.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be INSERTED FREE OF CHARGE. The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.

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WANTED—B. eye-piece (to fit Bausch & Lomb's smaller stands), a camera lucida, a stage micrometer (metric preferred) and a good turn-table; also Carpenter, or Beale, on the Microscope. Will exchange for above, books on Mineralogy and Chemistry and general literary works. Correspondence solicited. A. F. BARNARD, Box 152, Oberlin, O.

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F. L. CAUCH, Carpentry, Santa Barbara Co., Cal.

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EUGENE PINCKNEY, Dixon, Ill.

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CHAS. E. BARR, 301 Clinton St., Cleveland, O.

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JAMES E. WHITNEY, Rochester, N. Y.

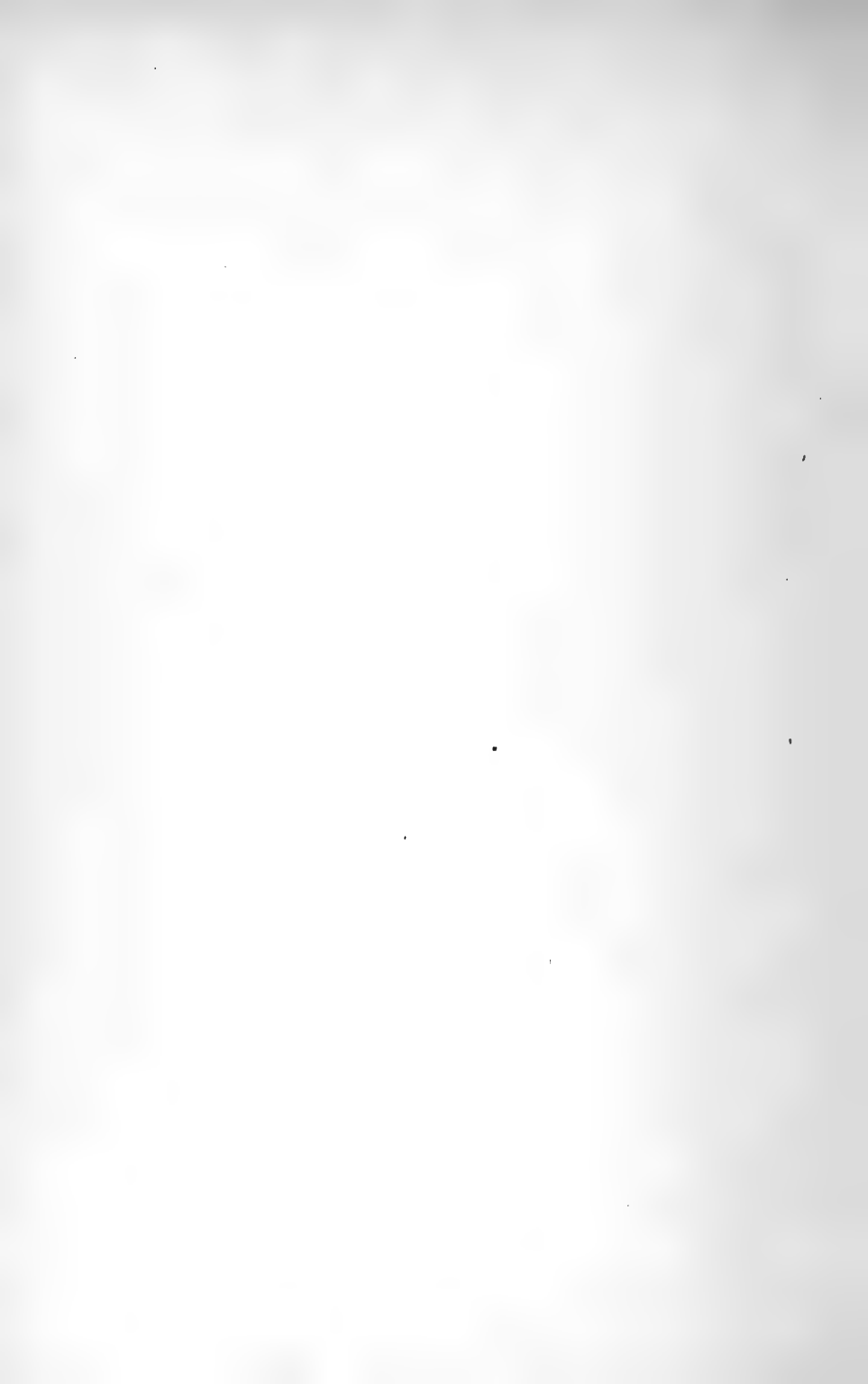
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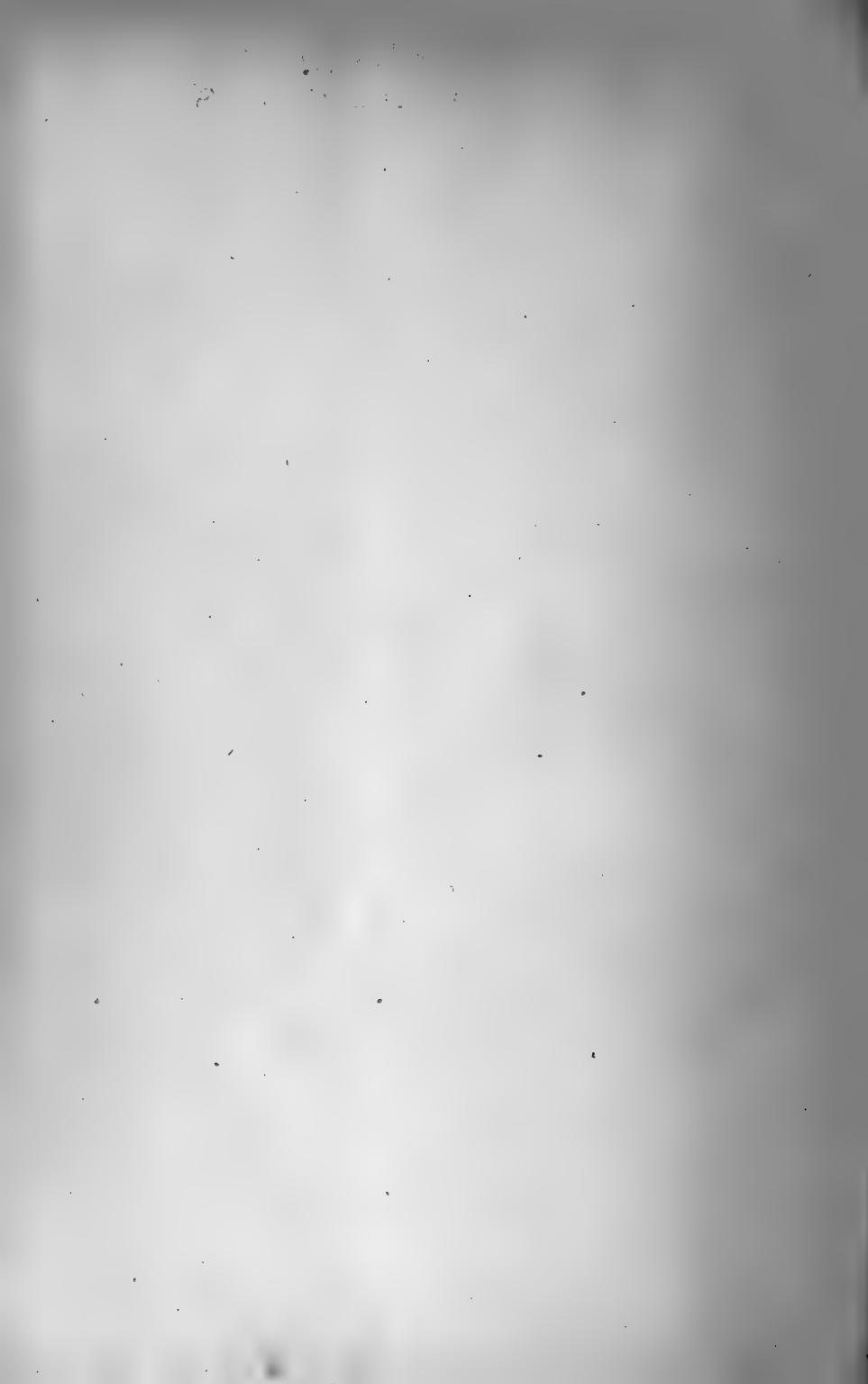
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D. M. FULLER, 154 Hamilton St., Albany, N. Y.

WANTED—Diatomaceous earth from Mejillanes, Bolivia, South America; can give in exchange either Diatomaceous earth from Zamara, New Zealand, or cash.
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